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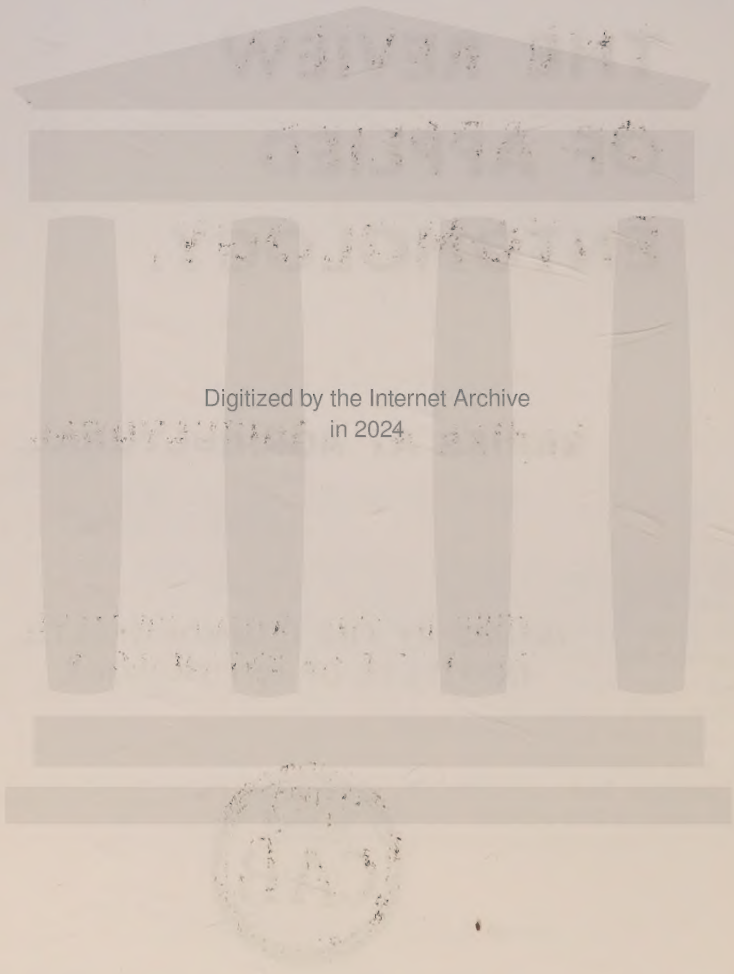
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LABEYRIE (V.) & PONS (R.). *Microgaster globatus* **Nees, nouveau parasite de la teigne du poireau** (*Acrolepia assectella* **Zeller**).—*Bull. Soc. ent. Fr.* **56** no. 2 p. 31, 1 ref. Paris, 1951.

The only parasite previously recorded from the leek moth, *Acrolepia assectella* (Zell.), in France was *Eulimneria* (*Limnerium*) *gracilis* (Grav.) [*cf. R.A.E.*, A **16** 289], but a dozen adults of the Braconid, *Microgaster globata* (L.) were obtained from larvae of *A. assectella* collected in the Gironde in October 1949, when there was about 10 per cent. parasitism. Only one parasite emerged from each host. The fully-fed parasite larva pupates on the host larva within its cocoon. The pupae overwinter, and the pupal stage lasts at least twice as long as that of the host, which overwinters as the adult. *M. globata* is known to parasitise the larvae of various Lepidoptera in France, and a list of these is given.

BERRY (P. A.) & PARKER (H. L.). **Notes on Parasites of** *Sitona* **in Europe with especial Reference to** *Campogaster exigua* **(Meig.) (Diptera, Larvaevoridae).**—*Proc. ent. Soc. Wash.* **52** no. 5 pp. 251–258, 10 figs., 5 refs. Washington, D.C., 1950.

In connection with the biological control of *Sitona cylindricollis* Fhs. on sweet clover [*Melilotus*] in the United States, surveys for parasites of *Sitona* spp., mostly on lucerne and clover [*Trifolium*], were begun in France in August 1947. A list is given of those recorded by Jackson on *Sitona* spp. in Britain [*cf. R.A.E.*, A **9** 171; **10** 473–474; **16** 621], and it is stated that the Braconids, *Microctonus aethiops* (Nees) and *Perilitus rutilus* (Nees), were reared from adults of *Sitona* spp. in northern and southern France, being most abundant in the south, and *P. rutilus* also from *Hypera variabilis* (Hbst.) (*postica* (Gylh.)), and the Tachinid, *Campogaster exigua* (Mg.), from *Sitona* spp. and *H. variabilis* in northern France. *C. exigua* was reared from 10 to 50 per cent. of the weevils in small collections made in July and August 1948, and though it did not afford control, it was considered that it might do so under favourable conditions. The maximum percentage parasitism by the Braconids was 2 in the north and 6 in the south. *C. exigua* was thus the most promising for introduction and the most likely to survive in the colder climate of the areas infested by *S. cylindricollis* in the United States.

Descriptions are given of all stages of *C. exigua*. The species of *Sitona* from which it was reared comprised *S. humeralis* Steph., *S. lineatus* (L.) and *S. hispidulus* (F.), but it probably attacks several if not all of the species of *Sitona* found, which also included *S. puncticollis* Steph., *S. sulcifrons* (Thnb.), *S. crinitus* (Hbst.) and *S. flavescens* (Marsh.), and possibly also *H. nigrirostris*(F.) and *H. meles* (F.). Sweet clover is rare in France, and *S. cylindricollis* was not taken in the few collections made, though the weevil is said to occur on it in northern and west-central France.

In the laboratory, adults of *C. exigua* survived for 20–30 days and larviposition began 10–15 days after pairing when honey and water were provided. Females that were 10 days old and had not previously deposited larvae matured about 100–150 eggs each. A single larva was deposited apparently externally between the head and thorax or the first and second thoracic segments of the adult weevil. It could not be found immediately after deposition, but dissection after one day showed it in the body cavity. The larval stage in the host lasted 20–30 days, though it is known to be prolonged indefinitely during cold weather. The larvae probably overwinter in the living hosts, but this has not been proved, and 25 adult parasites emerged from overwintered puparia between 8th and 19th April 1948. The pupal stage, which is passed in the body of the host, lasted 18–25 days.

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The methods of collecting and rearing the weevils and their parasites and of despatching the latter to the United States are described. In all, 430 cocoons of the Braconids were obtained from 115,000 weevils in 1947–8 and sent by air, in glass vials, to North Dakota [*cf.* **40** 152–153, etc.], most of them arriving in good condition. Dead weevils from lots fairly heavily parasitised by *C. exigua* were despatched in wet, dry or slightly damp sphagnum moss, the last being the most successful. During 1947 and 1948, 175 adults of *C. exigua* were obtained from the material forwarded.

BUTOVITSCH (V.) & LEKANDER (B.). **Husbocken och andra virkesförstörande insekter inomhus.** [*Hylotrupes bajulus* (L.) and other wood-destroying Insects that occur in Buildings.]—32 pp., 27 figs. Johanneshov, B. Lekander, 1951. Price Kr. 1.25.

This booklet is similar in scope to one already noticed [*R.A.E.*, A **40** 55] and contains general information on the appearance, bionomics and distribution in Sweden of various insects injurious to timber in buildings there [*cf.* **40** 361, etc.]. With the exception of *Sirex* and *Camponotus herculeanus* (L.), all are Coleoptera. Keys to them are given based on adult morphology and on the mines or exit holes, and methods of preventing and controlling infestations are discussed.

LEKANDER (B.). **Nyare bekämpningsmetoder mot granbarkborren.** [Modern Control Methods against *Ips typographus*.]—*Norrlands SkogsvFörb. Tidskr.* 1951 no. 1 pp. 9–22, 2 maps, 1 fig., 8 refs. Umeå, 1951 ; also as *Medd. SkogsforsknInst.* Ser. Uppsats. no. 19. Stockholm, 1951.

Ips typographus (L.) is a serious pest of spruce in Sweden and occurs throughout the area of natural distribution of that tree. Outbreaks occur from time to time [*cf. R.A.E.*, A **31** 260], when healthy trees are attacked and killed, and one that lasted from 1947 to 1950 and resulted in the death of nearly 20,000 trees over a forest area of some 650 acres in east-central Sweden is described. Recent work in other countries on control by the use of insecticides on trap-logs is reviewed [*cf.* **39** 32, etc.], and preliminary experiments on other methods carried out in Sweden in 1949–50 are described. The first concerned the injection of insecticides into newly infested standing trees. Various materials were introduced through four small holes at the bases of individual trees, and promising results were obtained by one containing fluorine salts (Fluralsil) and by arsenic. Since fluorine is easily detectable by chemical means, Fluralsil was studied in more detail, and it was found that the material was carried as far as the top of the tree in a narrow band arising from each hole, giving complete mortality of larvae in the band, but did not spread laterally. In a subsequent test, a ring of bark was removed from the trees in spring, a paste of osmotic Fluralsil applied all round, and the treated area covered with paper. Observations in autumn showed that no eggs or larvae had developed above the rings and females in the galleries were dead. Development was normal below the rings. The compound had again been carried right up the trees. It was not known how well trees treated in this way in early spring and felled would serve as trap-logs.

Investigations in central Europe have shown that the adults of *I. typographus* normally overwinter in the trees, and do so in the soil only exceptionally [*cf.* **39** 32, 77, etc.], but it was found in the outbreak centre of 1947–50 in Sweden that the great majority overwintered beneath moss and other vegetation beneath the trees, very few occurring under the bark. Various sprays were applied to the moss in 1949, and subsequent observations showed that an emulsified solution of DDT (Gesafid) killed 90 per cent. of the beetles beneath it.

In another test, promising results were given by burning the ground round the trunks. Most of the beetles were found to overwinter in the upper soil layer, and a temperature of 50°C. [122°F.] killed them in a few minutes. Such treatment might be combined with general clearing operations, and could be carried out in spring after the snow melts and before the beetles leave the soil, or in autumn, after they have entered it.

GÖRNITZ (K.). **Anlockversuche mit dem weiblichen Sexualduftstoff des Schwammspinners** (*Lymantria dispar*) **und der Nonne** (*Lymantria monacha*). [Tests of the Attractiveness of the Sex Scent of Females of *L. dispar* and *L. monacha*.]—*Anz. Schädlingsk.* **22** pt. 10 pp. 145–149, 11 refs. Berlin, 1949.

The author reviews work in the United States on the sex attractant produced by females of *Lymantria dispar* (L.) [*cf. R.A.E.*, A **33** 239, etc.] and describes experiments near Berlin in 1942–43 and 1947–48 with benzene extracts of the tips of the abdomens of unfertilised females and with the females themselves. It was found that males of *L. dispar* were lethargic in captivity and did not react uniformly to the extracts or the females. Extracts placed out of doors attracted males, even when prepared from dried abdominal tips four years old. Males of *L. monacha* (L.) were also attracted to the extracts of *L. dispar*, but few males of the latter were attracted to extracts from females of *L. monacha*. Unfertilised females of *L. dispar* also attracted males of both species, whereas one of *L. monacha* attracted males of its own species only. In cages, females of *L. dispar* avoided males of *L. monacha*, pairing was not observed, and the numerous eggs laid were not viable, while males of *L. dispar* and females of *L. monacha* remained indifferent to one another and the eggs were again non-viable.

DOSSE (G.). **Starkes Schadauftreten von** *Cylindroiulus teutonicus* **Pocock an Wintersalat und** *Blaniulus guttulatus* **Gervais, Latzel an Kohl.** [A severe Outbreak of *C. teutonicus* on Winter Lettuce and *B. guttulatus* on Cabbage.] —*Anz. Schädlingsk.* **22** pt. 10 pp. 153–155, 1 fig., 8 refs. Berlin, 1949.

Winter lettuce growing in a field near Stuttgart was severely damaged in April 1949 by *Cylindroiulus teutonicus* Pocock, which attacked the root-collars. Millepedes are not normally primary pests [*cf. R.A.E.*, A **31** 37], and it is considered that the plants must have been weakened by unfavourable weather [*cf.* **20** 108]. Good control was obtained by pouring 0·015 or 0·008 per cent. E 605 forte [an emulsion concentrate containing 50 per cent. parathion] in water round the roots at the rate of nearly a pint per plant. The treatment was somewhat impaired by rain, but a second application of the higher concentration in liquid manure at half the rate gave almost complete control. In a laboratory test, complete mortality of the millepedes in pots of earth was obtained in rather over a week following a single treatment with 0·015 per cent. E 605 forte at about 7·5 pints per sq. yard.

Towards the end of May 1949, large numbers of another millepede, *Blaniulus guttulatus* (Bosc), occurred in a neighbouring area on cauliflower and cabbage, both alone and in association with larvae of *Hylemyia* (*Chortophila*) *brassicae* (Bch.). The injury caused to the roots by the two pests was similar, and complete control of both was obtained by watering the plants with 0·015 per cent. E 605 forte or 0·1 per cent. E 605 folidol [10 per cent. in water of an emulsion concentrate containing 70 per cent. parathion] at the rate of nearly 1·8 pints per plant, provided that the soil was broken before treatment.

BECKER (G.). **Beobachtungen über Erholung von Scheintodlähmungen durch Kontaktgifte bei Cerambyciden.** [Observations on the Recovery of Cerambycids from apparently fatal Injury by Contact Poisons.]—*Anz. Schädlingsk.* **23** pt. 1 pp. 1–2, 18 refs. Berlin, 1950.

In the laboratory experiments described, males of various ages of the Cerambycid, *Hylotrupes bajulus* (L.), were confined for an hour at 19–20°C. [66·2–68°F.] and 70–80 per cent. relative humidity on filter paper, glass or pine sapwood that had been treated with p,p′ DDT, γ BHC, parathion or chlordane (M 410) in acetone solution at about 0·2 or 0·4 gm. per sq. ft. and stored for various periods. After exposure, the insects were transferred to untreated filter paper and kept under the same conditions. The course of paralysis and death was as expected for the lower deposits on all the substrata and in general for the higher ones on glass or paper, but some of the results for the latter on wood were anomalous. Of 12 individuals exposed to BHC, three that were motionless three hours after contact showed only slight paralysis of the extremities after 24 hours, but died on the next day. One individual exposed to DDT behaved similarly, while another one exposed to parathion was apparently dead after 24 hours, but recovered completely within 5–7 days of treatment. One beetle that was motionless two days after contact with chlordane became active again from the third day. In general, insects that recovered suffered severe injury earlier than others. The significance of these findings is discussed with respect to the view that mortality can be assumed in insects that have reached the inactive phase [*R.A.E.*, A **38** 226].

FRANCKE-GROSMANN (H.). **Über ein Massenvorkommen von *Gilletteella*-Gallen an Sitkafichten (*Picea sitchensis* Carr.).** [On a Mass Occurrence of *Chermes* Galls on Sitka Spruce (*P. sitchensis*).]—*Anz. Schädlingsk.* **23** pt. 1 pp. 3–6, 7 figs., 12 refs. Berlin, 1950.

Although *Chermes* (*Gilletteella*) *cooleyi* Gill. has been present in Europe on Douglas fir [*Pseudotsuga taxifolia*], its secondary food-plant, for some 25 years, it has only comparatively recently been observed there causing galls on spruce, its primary food-plant [*R.A.E.*, A **25** 282 ; **32** 70, 157 ; **37** 322], in spite of the presence of suitable species. In 1940, galls were found to be common on Sitka spruce (*Picea sitchensis*) in the district of Reinbek, near Hamburg, and have occurred there each year since. They were found on trees in gardens and parks and were particularly numerous in a stand of Sitka spruce mixed with Douglas fir.

Observations on the bionomics of the Aphid at Reinbek showed that the sexuparae migrated in late May or early June from Douglas fir to Sitka spruce, fed on the needles of the current and of the previous year, and deposited 15–20 eggs each. The sexuales that hatched from these developed in close proximity to the parent, under the wax exuded by it, and later moved to the base of the shoots, where the females laid a single egg each under the old bud scales. The fundatrices hatched from these at the end of July, fed on the undersides of the shoots and overwintered in the first instar. The first moult occurred at the beginning of April and was quickly followed by two more, and oviposition began at the end of the month, a total of about 350 eggs being laid per female. Hatching began in early May, and the Aphids of this generation (cellares) moved to the growing shoots, where they fed at the base of the young needles, causing the development of multi-cellular galls. The galls normally opened in late August or early September, and the fully-developed nymphs emerged from them and moulted, giving rise to adults (migrantes alatae) that flew to Douglas fir and laid 80–100 eggs each, from which the

overwintering generation (hiemales) arose. The galls are described. Some were occasionally found to have been formed in association with *Chermes* (*Sacchiphantes*) *abietis* L.

The Aphid was attacked on Sitka spruce by numerous predators. Small spiders preyed on the young fundatrices, larvae of a Cecidomyiid were frequently found in considerable numbers in the galls, where they attacked the cellares, *Dioryctria* (*Phycis*) *abietella* (Schiff.) fed on the galls themselves, and the Coccinellids, *Exochomus quadripustulatus* (L.), *Coccinella undecimpunctata* L., *C. quinquepunctata* L. and *Aphidecta obliterata* (L.), destroyed the alates (sexuparae and migrants), but were present only in small numbers.

After the Aphids had left the galls, the shoots bearing them usually died. Young trees were most commonly attacked, but they usually recovered, and the damage to trees over about six feet high was negligible. Mass outbreaks seemed unlikely to occur on Sitka spruce, and it appears that certain unknown conditions must be fulfilled before holocyclic development, with gall formation on spruce, takes place on a large scale.

LANGE (B.). **Über Schädigungen an Äpfeln durch Larven der Blattwespe** *Ametastegia* (*Taxonus*) *glabrata* **Fall.** [On Damage to Apples by Larvae of the Sawfly, *A. glabrata*.]—*Anz. Schädlingsk.* **23** pt. 2 pp. 23–24, 5 figs., 6 refs. Berlin, 1950.

At the end of September 1942, about 50 per cent. of the apples growing in an orchard in Oldenburg were damaged by larvae of the Tenthredinid, *Ametastegia glabrata* (Fall.), which either fed on the surface of the ripening fruits or bored into the flesh, sometimes reaching the core. The injured fruits were rapidly attacked by fungi. The species normally feeds on dock [*cf. R.A.E.*, A **25** 665], but no infestation was found either on *Rumex* or on *Polygonum* growing in the vicinity. Similar damage is caused in the United States and Canada by the third and fourth generations of the year. There are not normally so many generations in Europe, but it is considered possible that the exceptionally long and moist summer of 1942 favoured development.

ZIEGER (E.). **Über die Anwendung der Dämpfmethode in der Borkenkäferbekämpfung.** [On the Use of the Steam Method for Bark-Beetle Control.] —*Anz. Schädlingsk.* **23** pt. 3 pp. 35–39, 2 figs. Berlin, 1950.

Large quantities of spruce bark are required for tanning purposes in Germany, and supplies were rendered difficult by the outbreaks of *Ips typographus* (L.) on that tree that began about 1946. The usual method of control is to strip and burn the bark, but as infested bark can still be used for tanning if at least half the bast layer remains, a measure was sought that would not involve its destruction. In experiments in Saxony in 1946–47, stripped bark was treated with steam in low-pressure boilers at 105–110°C. Complete control of all stages of *I. typographus* was obtained, but it was found that many adults escaped during the barking operations. Logs were therefore treated with steam in special apparatus in the autumn of 1947 before being barked. After three minutes' treatment, the temperature at the junction of wood and bark reached 100°C. and mortality was invariably complete. The method was also found useful for treating trap-logs, which could subsequently be used again. The adults oviposited in treated logs, but during preliminary investigations, development was not completed in them.

VAN DINTHER (J. B. M.). **Bestrijdingsproeven tegen** *Eriophyes avellanae* **Nal. en** *Eriophyes gracilis* **Nal.** [Control Experiments against *Phytoptus avellanae* and *Phyllocoptes gracilis*.]—*Tijdschr. PlZiekt.* **58** pt. 4 pp. 96–103, 2 refs. Wageningen, 1952. (With a Summary in English.)

Notes are given on the bionomics of *Phyllocoptes* (*Eriophyes*) *gracilis* (Nal.) on raspberry and *Phytoptus* (*E.*) *avellanae* Nal. on filbert [*Corylus avellana*] in Holland, together with accounts of experiments in 1951 on their control. The information on the bionomics of *Phyllocoptes* is taken from a more detailed account [*R.A.E.*, A **40** 279]. In the experiments, dormant sprays of 5 or 7 per cent. tar distillate (fruit-tree carbolineum) or 5 per cent. mineral oil applied in March to raspberry canes brought into the laboratory killed 95–100 per cent. of the mites with which they came into contact. Those overwintering in the buds (about half the total number of mites) escaped treatment. At the beginning of May, when the mites were migrating to the leaves, sprays containing 0·2 per cent. parathion as an emulsion concentrate or 0·75 per cent. wettable sulphur were applied twice to canes in the field at an interval of about a week. The results were evaluated on 18th May by counting the living mites on the leaves. Wettable sulphur gave good control, whereas parathion had little effect.

Phytoptus avellanae causes deformation and swelling of the buds of filbert. The mites overwinter in the buds, and large numbers, probably of a new generation, migrate to all parts of the bushes in May, eventually reaching the young leaves and new shoots. Mites continue to leave the old buds until these die at about the end of June. They enter the new buds towards the end of May causing them to swell, so that infested buds could be distinguished by July or August by their size and appearance, which are described. The numbers of mites per bud reached 60–70 in early August, 200–300 in September and over 1,000 in late autumn. Winter sprays had no effect on the mites, since they were well protected in the buds. In further tests, sprays of 2 per cent. lime-sulphur, 2 per cent. wettable sulphur or 0·05 per cent. parathion were applied in an attempt to prevent the mites that left the old buds from reaching the new ones. All the bushes were sprayed on 16th, 23rd and 30th May, and some also on 9th and 20th June. At the end of June, samples of buds were examined, and the percentages infested were 41 for no treatment and 32 and 34, 26 and 15, and 27 and 11 for three and five treatments with parathion, lime-sulphur and wettable sulphur, respectively. It is concluded that at least five applications are needed to give good control. The superior results obtained with wettable sulphur were in part due to the fact that it persisted on the bushes for some 7–10 days.

PITCHER (R. S.). **Observations on the Raspberry Cane Midge** (*Thomasiniana theobaldi* **Barnes). I. Biology.**—*J. hort. Sci.* **27** no. 2 pp. 71–94, 3 pls., 6 figs., 18 refs. London, 1952.

PITCHER (R. S.) & WEBB (P. C. R.). **II. "Midge Blight", a fungal Invasion of the Raspberry Cane following Injury by** *T. theobaldi*.—*T.c.* pp. 95–100, 2 pls., 10 refs.

These detailed accounts of investigations on *Thomasiniana theobaldi* Barnes and the fungi associated with it on raspberry carried out in south-eastern England in 1946–48 contain much information already noticed from a shorter report of the first two years of work [*cf. R.A.E.*, A **40** 256].

The first part includes the results of work on the bionomics of the Cecidomyiid [*loc. cit.*] and notes on its natural enemies. The larvae are parasitised by the Platygasterids *Piestopleura catillus* (Wlk.) and *Leptacis* sp. Adults of the overwintering generations of these emerge in June-July, considerably later

than those of the host, and attack mainly the second-generation larvae in the last instar on the canes. Adults emerge from these in late August and attack larvae of the third generation. Parasitised larvae fall to the ground in the normal way, but their skins become swollen and hard after they have formed their cocoons, and the parasite larvae pupate within them. A considerable degree of parasitism (20–30 per cent.) was observed only once. The parasite recorded by Barnes [**32** 259 ; **33** 308] is the Eulophid, *Tetrastichus inunctus* (Nees). It was found in small numbers in several localities and increased considerably between 1946 and 1948, causing a considerable reduction of the second and third generations of the host in one locality. The adults emerged in late May or early June in 1947 and attacked mainly the first host generation. The host larvae are soon immobilised, and the parasites develop within them. Adults emerge in August and attack the late second and third generations, and the resulting larvae overwinter on the canes, within the host skins. Predacious larvae of a species of *Lestodiplosis* [*cf.* **33** 308] were found in the splits on the canes from mid-July onwards, but had little effect as their numbers never exceeded 2·6 per cent. of the population of *Thomasiniana*. Nymphs of *Anthocoris nemorum* (L.) also fed on the larvae of *Thomasiniana*, but did not markedly reduce the population. Further investigations on food-plant preferences [*cf.* **33** 308] confirmed the view that *T. theobaldi* is a distinct species, since it proved incapable of reaching large numbers on any food-plant but raspberry.

The second part contains brief accounts of the type of injury characteristic of larvae of each of the three generations of *T. theobaldi* and the results of investigations on the fungi that attack the plant at the points of infestation. Three species, *Fusarium culmorum*, *Didymella applanata* and *Leptosphaeria coniothyrium*, were isolated consistently from lesions within the feeding areas of the larvae and proved capable of producing similar lesions when re-inoculated into young canes. Spores of all three were found amongst the fungal flora of the epidermis of healthy canes, but they could not be cultured from the exterior of adults of *T. theobaldi*, and it is therefore concluded that the larvae produce a substrate suitable for the development of spores of the pathogens already present on the canes. The name " midge blight " is suggested for the condition resulting from the attack.

COLLYER (E.). **Biology of some predatory Insects and Mites associated with the Fruit Tree Red Spider Mite (*Metatetranychus ulmi* (Koch)) in south-eastern England. I. The Biology of *Blepharidopterus angulatus* (Fall.) (Hemiptera-Heteroptera, Miridae).**—*J. hort. Sci.* **27** no. 2 pp. 117–129, 1 pl., 5 figs., 15 refs. London, 1952.

Predators are the most important agents of natural control of *Paratetranychus pilosus* (C. & F.) (*Metatetranychus ulmi*, auct.) on fruit trees in south-eastern England [*cf. R.A.E.*, A **40** 141] but are harmed by treatments with modern insecticides. Numerous species are concerned, and an investigation of their bionomics and economic significance in Essex and Kent was begun in 1945. Observations were made in commercial orchards, a neglected orchard and the laboratory, and the author here gives an account of the work on *Blepharidopterus angulatus* (Fall.), which proved to be the most consistent and numerous predator present. This Mirid was found in large numbers on apple, plum, damson, pear, cherry and walnut, particularly when these were infested by *P. pilosus*, and in small numbers on various trees and bushes in neighbouring hedges and woods. All stages are described. On apple, the eggs were laid singly in shoots 1–3 years old in July–October, and hatched between the following May and July or August, the date varying in different orchards and from year

to year. Hatching began 3–4 weeks earlier in a sprayed than in an unsprayed orchard, though it finished almost simultaneously in both, whereas hatching of *P. pilosus* began more than a week later in the sprayed than in the unsprayed orchard. The nymphs passed through five instars in 25–44 days in 1947 and in 27–53 in 1948, when the weather was cooler and less settled ; nymphs that hatched in May or early June required longer to complete development than those hatching later. Adults appeared in July, and males predominated early in the summer and females at the end of it. Females lived for 6–8 weeks and were active on the trees as long as leaves or mites remained, in some years until October, whereas males lived for 3–4 weeks and rarely survived until September. Mating took place 5–6 days after the last moult, and oviposition began 6–7 days later. In the laboratory, females laid an average of 43 eggs in 51 days. In commercial orchards, *B. angulatus* feeds mainly on *P. pilosus*, but also attacks *Bryobia praetiosa* Koch, other phytophagous mites, Aphids, and thrips and occasionally predacious Laelaptid mites. In the absence of more suitable food, it attacks other predacious insects. All stages are predacious, and in the laboratory, females devoured an average of 3,248 adult female mites each in 1947 and some 4,000 in 1948. Nymphs and adults were also observed sucking the leaves and fruitlets, but caused no obvious damage to the plant tissue. They could not be kept alive on foliage alone, but the introduction of very little animal food was sufficient for survival. Late in the season, they were seen feeding on rotten fruits on the tree or on the ground.

DICKER (G. H. L.). **The Biology of the Strawberry Aphid, *Pentatrichopus fragaefolii* (Cock.), with special Reference to the winged Form.**—*J. hort. Sci.* **27** no. 3 pp. 151–178, 14 graphs, 32 refs. London, 1952.

The author has been informed by Hille Ris Lambers that the synonymy of *Capitophorus* (*Pentatrichopus*) *fragariae* (Theo.) with *C.* (*P.*) *fragaefolii* (Ckll.), which has long been considered doubtful [*cf. R.A.E.*, A **30** 210], has been proved by examination of type specimens. He reviews published data on the food-plants of this Aphid in Britain, showing that it is practically confined to cultivated strawberry [*cf.* **30** 243], and describes investigations in southern England on its bionomics. The following is largely based on his summary of this account of the work.

The results are given of insectary investigations on the rate of development of the nymph and the fecundity of the apterous adult. In 1943–46, intensive sampling of selected infested fields throughout the year in Kent and from May to July in Hampshire, Worcestershire and the Isle of Ely showed that two distinct rhythms exist in the annual cycles of the Aphid. On first-year plants, the population rises to a peak in late summer or early autumn and then declines, whereas on older plants, a peak is reached in late May or June, followed by a rapid decline, with low populations persisting for the rest of the year. Alates occur from early May until late June or July and in greatly reduced numbers from October until January or February. Observations on the development of infestation in first-year strawberry beds indicated that the alates do not remain long on any one plant, but feed and deposit a few nymphs on several plants in turn, so that one Aphid infected with virus may infect several plants ; also, since many plants are colonised at an early stage, subsequent spread by wingless forms results in the rapid development of infestation over the whole field.

Evidence is presented suggesting that the rapid decline in population during June on plants over one year old is primarily due to a reduction in the number and quality of the young leaves produced at that time as a result of fruit development.

BORG (Å.). **Undersökningar över *Aphelinus mali* Hald.—blodlusens (*Eriosoma lanigerum* Hausm.) speciella parasit.** [Investigations on *A. mali*, the special Parasite of the Woolly Apple Aphis (*E. lanigerum*).]—*Medd. Växtskyddsanst.* no. 60, 75 pp., 13 figs., 11 graphs, 5 pp. refs. Stockholm, 1952. (With a Summary in English, pp. 63–70.)

Aphelinus mali (Hald.) was liberated in Sweden for the control of *Eriosoma lanigerum* (Hsm.) on apple in 1934 and 1937. It spread fairly rapidly and now occurs throughout the area of distribution of the Aphid in the south of the country. All stages of the parasite are described, its synonymy, world distribution and alternative hosts are reviewed, and an account is given of investigations in Sweden, largely carried out in 1946–48, on its bionomics and the effect on it of insecticides applied against *E. lanigerum* or other pests of apple, the results of which are compared with those recorded in the literature.

The egg stage lasted 3–4 days under favourable conditions, and the larval and pupal stages 10–12 and 10 days, respectively, in the warm months. The parasite usually overwinters in the larval stage in its dead host, but a few pupae were found in addition to larvae when parasitised host material was dissected in November 1948, and some of these apparently survived the winter. Low temperatures cause little winter mortality of the parasite in Sweden [*cf. R.A.E.*, A **37** 455]. The first adults emerged in the insectary in the first week of May in 1946 and 1948, and in tests in which overwintering larvae were kept at various constant temperatures, the lowest temperature at which adults emerged was about 12–13°C. [53·6–55·4°F.]. In experiments on the duration of the life-cycle in the open, eggs laid on 24th August 1947 gave rise to adults after 22 days, but this is thought to be less than the period normally required, owing to the high prevailing temperatures in that year. In a test begun with the release of adults on infested apple in a cage on 4th May 1948, five complete generations were obtained by mid-September, together with larvae of a sixth. The adults survived longest in the laboratory (up to 47 days) with access to honey. The sex ratio was variable, though females were always more numerous than males, and unfertilised females reproduced, giving rise to males only.

Several parasites, a list of which is given, have been recorded from *A. mali* in other countries, but the only hyperparasite that emerged from batches totalling over 3,000 parasitised hosts collected in the field was a single example of a species of *Pachyneuron*, probably *P. aphidis* (Bch.). *A. mali* was little affected by insect predators of *E. lanigerum*, which are not usually common in Sweden. Exposure to a temperature of 40°C. [104°F.] killed the adults in an hour. Observations on the course of parasitism over a period of about a year showed that it rarely exceeded 30 per cent. and sometimes fell to below 10 per cent. Such low rates probably had little effect on the increase of the host, but parasitism is higher in some orchards and almost reached 47 per cent. in one near Malmö visited in July 1948.

Various winter and summer sprays were tested for their effects on *A. mali*. Tar distillates and DNC in oil emulsion caused little mortality of the overwintering larvae at the concentrations normally applied, though both were injurious at higher ones. Of the summer sprays, DDT, BHC, nicotine, and lime-sulphur caused no reduction in adult emergence, but hexaethyl tetraphosphate at the usual strength caused considerable decreases. Both nicotine and BHC were injurious at higher concentrations. Fumigation for 6 hours at 18°C. [64·4°F.] with hydrocyanic acid gas caused mortality proportionate to the concentration used, the percentage mortality increasing from 16 for no treatment to nearly 30 for a concentration of 0·01 volume per cent. and to over 44 for one of 0·04 volume per cent. ; the percentage mortality of *E. lanigerum* was 90 for 0·015 and 100 for 0.03 volume per cent. In tests with adults of *A. mali*, deposits on apple from sprays of 0·075 per cent. DDT, alone or with

Bordeaux mixture or lime-sulphur, and 0·01 per cent. BHC gave complete mortality on the day of application. BHC lost its toxicity in five days, but DDT remained highly injurious for a month, still causing complete mortality when used with lime-sulphur.

SYLVÉN (E.). **Några hortikulturellt anmärkningsvärda gallmyggor.** [Some horticulturally noteworthy Gall-midges.]—*Medd. Växtskyddsanst.* no. 61, 12 pp., 4 figs., 18 refs. Stockholm, 1952. (With a Summary in English.)

The Cecidomyiids here recorded from Sweden include *Thomasiniana theobaldi* Barnes on raspberry and *Dasyneura tetensi* (Rübs.) on black currant, neither of which has previously been reported from that country. Larvae of *T. theobaldi* were observed beneath the bark of raspberry canes [*cf. R.A.E.*, A **41** 39] in southern Sweden and also in Denmark in September 1948, and adults were reared in 1949 and 1950. The record of *D. tetensi* is based on the finding of larvae causing characteristic damage near Stockholm in 1947; adults were not obtained. The other two species recorded are *D. alpestris* Kieff. (*schneideri* Rübs.), on *Arabis*, and *Contarinia quinquenotata* (Lw.), not previously known from Sweden, on *Hemerocallis*. A parathion spray proved effective against the young larvae of *D. alpestris*.

MATHLEIN (R.). **Undersökningar över uppkomst av DDT-resistens hos kornvivel, *Calandra granaria* L.** [Investigations on the Development of Resistance to DDT in the Grain Weevil, *C. granaria*.]—*Medd. Växtskyddsanst.* no. 62, 20 pp., 1 graph, 8 refs. Stockholm, 1952. (With a Summary in English, pp. 17–20.)

Since house-flies (*Musca domestica* L.) have been shown in various countries to have become resistant to DDT, experiments were carried out in Sweden to ascertain whether *Calandra granaria* (L.), which is commonly controlled in stored grain by means of DDT dusts, might also become resistant to it. In preliminary tests, 500 weevils of various ages were liberally treated with a 5 per cent. DDT dust and transferred an hour later to jars containing wheat grains. From those that were not affected after 14 days (9 per cent. of the total), a second generation was obtained. This was not treated, as it consisted of insufficient individuals, but the third and fourth generations were treated and the percentages not affected after 14 days were 25 and 45, respectively.

More detailed experiments were carried out with the progeny of the fourth generation, batches of 100 weevils being exposed for 20 hours to the dust in petri dishes, then removed while the dishes were cleaned and furnished with wheat grains, and finally returned to them. The temperature was 25°C. [77°F.], and control series were set up consisting of treated insects from an untreated strain. Weevils not affected after 14 days were used as the parents of the fifth and sixth generations, and those not affected after 21 days as the parents of the seventh and eighth. In the fifth generation, the percentages not affected after 5 and 14 days averaged 20·2 and 0·4, respectively, when the moisture content of the wheat in which the weevils had been reared was 12·5 per cent., and 30 and 0 when it was 16 per cent., as compared with 6·8, 0, 1·4 and 0 in the controls. The wheat in which subsequent generations were reared had a moisture content of 14·5 per cent. In the sixth generation the percentages unaffected averaged 96·6, 58·4, 31·7 and 24·7 after 5, 14, 21 and 28 days, as compared with 66·6, 5·3 and 0 after the first three periods in the controls. In the seventh generation, the percentages unaffected after 5, 14 and 21 days were 83·1, 71·9 and 58·8 after 5,14 and 21 days, as compared with 41.[illegible] and in the eighth, they were 99·4, 75 and 41·6 after the same periods, compared with 96·6, 13·4 and 2·2.

Subsidiary tests with weevils of some of these generations showed that older individuals were more susceptible to DDT than younger ones, and that permanent exposure to a DDT film lightly covered with a layer of flour resulted in complete mortality in all series, though the control insects succumbed sooner than the others. Weevils of the eighth generation were also more resistant than the controls to a powder preparation containing 0·25 per cent. pyrethrum and 4 per cent. piperonyl butoxide, and though a 5 per cent. chlordane dust paralysed or killed all the weevils of both series in five days, the mortality percentages were 2·5 for the treated line and 37 for the controls. Measurement of weevils from the eighth generation showed some correlation between size and resistance to DDT, but not sufficient to cover the whole range of resistance.

FABER (W.) & SCHREIER (O.). **Maikäfer-Bekämpfungsversuche 1951 in Österreich.** Experiments on the Control of *Melolontha* in Austria in 1951.—*Pflanzenschutzberichte* **8** pt. 7–8 pp. 97–117, 2 maps, 13 refs. Vienna, 1952. (With a Summary in English.)

Experiments were carried out in two districts in eastern Austria in the spring of 1951 on the control of local populations of *Melolontha* by spraying or dusting trees at the edges of woodlands or roads against the feeding adults [*cf. R.A.E.*, A **40** 188]. The main species concerned was *M. melolontha* (L.), but small numbers of *M. hippocastani* F. were also present in one of the areas.

In all, about 45 miles of forest edge and 19 miles of roadways were treated, and the insecticides used, all of which were proprietary products, included sprays of DDT and BHC, either singly or combined, or E 605 f [parathion], and dusts of BHC or E 605 Staub [methyl-parathion]. The dates for carrying out the treatments were determined by the method of Vogel [*loc. cit.*], and the results of observations on the state of development of the foliage, the sex ratio among the Melolonthids on the trees and the degree of maturity of the eggs during the relevant parts of April and May are given in tables. The main treatments were begun on 28th April in one district and on 2nd May in the other and were completed before the females left the trees to oviposit [*cf.* **40** 399]. Most of the insecticides gave high mortality, but the DDT preparations appeared inferior to the others. Sprays were in general superior to dusts, and BHC sprays are recommended for future operations. No damage to forest animals or to bees was reported, but about 100 hens that were accidentally dusted with BHC died and three cows that repeatedly fed on treated grass showed symptoms of poisoning, though they later recovered. A day or two after the first main flight to the trees, infestation spread deeper into the forest, with the result that a high percentage of the beetles reached untreated foliage, and since the numbers of females that returned to the trees for further feeding were considerable, a second application was made 10–14 days after the first.

The results of the work were assessed in the following September-October by comparing the numbers of first- and second-instar larvae in soil from uncultivated plots near treated areas with those from plots near untreated woodland in the vicinity. In both districts, a reduction in infestation of just over 50 per cent. was found. In a discussion of the effectiveness of the method it is pointed out that the main difficulty is to prevent the adults from penetrating beyond the fringe of the woods. This might be done by planting suitably sited belts of *Robinia* spp. which were little attacked and might cause the beetles to congregate in more readily accessible spots. It might prove advantageous to apply the first treatment at the time of the main flight to the trees, so as to allow the oviposition to be completed before the first flight to the fields for oviposition.

BÖHM (H.). **Beitrag zur Biologie und Bekämpfung der Apfel- und Birnensägewespe (*Hoplocampa testudinea* Klug, *Hoplocampa brevis* Klug, Hymenopt., Tenthredinidae).** [Contribution to the Bionomics and Control of *H. testudinea* and *H. brevis*.]—*Pflanzenschutzberichte* **8** pt. 9–10 pp. 129–149, 8 figs., 34 refs. Vienna, 1952. (With a Summary in English.)

The distribution, bionomics and control of *Hoplocampa testudinea* (Klug) on apple and *H. brevis* (Klug) on pear are reviewed from the literature. These sawflies are rarely injurious in Austria, but have increased in recent years, and investigations on their bionomics and control were carried out near Vienna and in Lower Austria in 1949–51. Both had only one generation a year. The adults emerged in late April or early May, when early varieties of apple and pear began to flower, and were present for an average of 18–20 days. No males of *H. brevis* were observed, and reproduction in that species was parthenogenetic. The average number of eggs laid per female in the laboratory was 25 for each species, and the oviposition period lasted 1–3 weeks according to weather. The larvae hatched in 10–14 days in *H. testudinea* and in 8–12 in *H. brevis* and became full-fed in 25–30 and 24–27 days, respectively, after which they left the fruits and overwintered in the soil. They pupated in the spring, the pupal stage lasting 20–25 days in both species. The damage caused to the fruits is described.

In the experiments on control, sprays of 0·03 or 0·04 per cent. of a preparation stated to contain 45 per cent. parathion, 0·2 or 0·3 per cent. of one containing 15 per cent. γ BHC, 1 per cent. of one containing 20 per cent. nicotine, or 0·2 per cent. of one containing 50 per cent. DDT, the last with a wetting agent, were applied to apple and pear just before the larvae hatched. Some of the trees were sprayed again eight days later, and a few of those treated with nicotine received a third application after another eight days. Effectiveness was assessed from both dropped and harvested fruit, and the infestation percentages are shown in tables. Single treatments with BHC or parathion gave excellent control of both *H. testudinea* and *H. brevis* in each year and reduced the average percentage infestation for all three years from 53·3 and 74·2, respectively, for no treatment to 7·7–2·1. The parathion preparation was superior to BHC at either concentration when used at 0·04 per cent., but inferior to it when used at 0·03 per cent. Second applications gave some further reductions but were not economically justified. Nicotine gave fair results after three applications, reducing the infestation percentages to 12·8 for apple and 14·4 for pear, but DDT proved unsatisfactory [*cf. R.A.E.*, A **40** 373].

HENNER (J.) & SCHREIER (O.). **Untersuchungen über das Auftreten von Blattläusen an Kartoffeln in Österreich in den Jahren 1950–1951 im Zusammenhang mit virösem Kartoffelabbau.** [Investigations on the Occurrence of Aphids on Potato in Austria in 1950–51 in Connection with Degeneration owing to Virus Infection.]—*Pflanzenschutzberichte* **8** pt. 9–10 pp. 150–159, 4 graphs, 9 refs. Vienna, 1952. (With a Summary in English.)

With a view to determining safe areas for producing virus-free seed potatoes in Austria, crops growing in 11 districts were sampled every fortnight between May and August or September in 1950–51 and records kept of the numbers of Aphids found per 100 leaves [*cf. R.A.E.*, A **22** 386]. The weather in both years was abnormal, and resulted in light infestation. *Myzus* (*Myzodes*) *persicae* (Sulz.) predominated, and its frequency in various localities and on an early and a late variety of potato is discussed. The early variety was in general the more heavily infested. There was some correlation between infestation and virus infection of the crop, but low counts (fewer than 20 Aphids per 100 leaves) were obtained in some areas in which infection is known to be high.

SCHENKER (P.). **Die Kleesamenrüssler oder Kleespitzmäuschen und ihre Bekämpfung.** [*Apion* spp. on Clover and their Control.]—*Landw. Jb. Schweiz* **65** pt. 7–8 pp. 713–725, 1 fig., 6 refs. Berne, 1951. (With a Summary in French.)

The yield of red-clover seed in Switzerland varies considerably in different years and localities, and several causes of poor harvests are enumerated. In some areas, considerable quantities of seed were found in recent years to be damaged by weevils of the genus *Apion*, the most important of which, in order of decreasing frequency, were *A. trifolii* (L.) (*aestivum* Germ.), *A. apricans* Hbst. and *A. assimile* Kby. These weevils have one generation a year. The adults overwinter among dead leaves and grass in hedges or at the edge of woodland, migrate to the clover fields during April or May and oviposit on the undeveloped flower heads. Oviposition mainly occurs from the end of June to mid-July, so that the second mowing was generally the most heavily infested. The Braconid, *Sigalphus floricola* Wesm., and the Pteromalid, *Spintherus obscurus* (Thoms.), were reared from the *Apion* larvae.

Indirect control can be obtained by cutting the second crop and growing an early third crop for seed. In tests of insecticides in 1948–49, several field experiments were carried out with proprietary sprays containing unstated amounts of DDT, BHC, parathion or chlordane, applied during the week before flowering began. All the materials gave effective control and considerable increases in seed yield, but DDT is recommended, since parathion is highly toxic to mammals and BHC and chlordane are liable to taint crops subsequently grown on treated ground. Good results were also obtained with DDT by growers. In cases of very heavy infestation, or in fields close to others in which clover is being cut, it is advisable to spray twice, once when the buds are forming and again just before flowering.

GEIER (P. W.). **Contribution à l'étude de la cochenille rouge du poirier (*Epidiaspis leperii* Sign.) en Suisse.**—*Rev. Path. vég.* **28** fasc. 4 pp. 177–261, 19 figs., 40 refs. Paris, 1949.

Epidiaspis leperii (Sign.) is one of the most important of the Coccids that attack fruit trees in Switzerland, especially in the south and west. It is most injurious in the vine-growing regions, where the climatic conditions favour it, and particularly where large numbers of pears, its main food-plant, are grown.

The author describes all stages of this Coccid and the structure and formation of its scale covering, reviews its synonymy and gives a list of its food-plants, with details of the effect of the type and age of these on its development. There is one generation in the year, and observations near Lake Geneva showed that the eggs are deposited between May and August and hatch in 2–3 weeks early in the season or in a few days towards the end of it. The crawlers settle in a few hours, and the females pass through two instars lasting about a month each and the males through two lasting a month and a fortnight, respectively, and a pupal stage lasting a fortnight. The males are active during August and die soon after pairing, whereas the females continue their development slowly throughout the winter and more rapidly in spring. They deposit about 40 eggs over a period of 3–6 weeks. Observations indicated that relatively few of the females were fertilised, and work is in progress on the possibility of parthenogenetic reproduction in this Coccid. The influence of environmental conditions on the development of the scale and its distribution and abundance is discussed in detail. Infested fruit trees rapidly lose condition and die unless protected. There are no important natural enemies of *E. leperii* in Switzerland; the Coccinellid, *Chilocorus bipustulatus* (L.), occasionally attacked isolated individuals, and the Aphelinid, *Aphytis proclia* (Wlk.), sometimes parasitised the females in winter.

Tests of emulsions of 80 per cent. white oil, alone and with 5 per cent. DNC, at concentrations of 3, 4 and 6 per cent. during the dormant period showed that the lowest concentration, which is the one normally used, was ineffective against the Coccid. At the higher concentrations, the addition of DNC increased the effectiveness of the sprays, and good control was obtained. It is suggested that the DNC spray should be applied at 4 per cent. once every 2–3 years against light infestations and at 6 per cent. for two years in succession, if necessary, against heavy ones. The latter treatment should be followed by protective applications at 4 per cent. at least once every second or third winter. Other materials tested were less effective. As young trees are very susceptible to attack, good sanitation is necessary in nurseries, and only uninfested trees should be transplanted to permanent positions. Regular treatment once every two years with the 4 per cent. spray is advisable in young plantings. In the course of tests against *Quadraspidiotus perniciosus* (Comst.) [*cf. R.A.E.*, A **40** 18], it was found that fumigation of nursery stock with hydrocyanic acid gas at 5 oz. per 1,000 cu. ft. for 30 minutes in airtight chambers gave complete control of *E. leperii*.

DE ROBERTIS (A.). **La lotta antiacridica. Rilievi sperimentali sull'uso dell'esaclorocicloesano e confronto tecnico-economico di tre diversi metodi di impiego.** [Locust Control. Experimental Findings on the Use of BHC and an economico-technical Comparison of three different Methods of Application.]—*Ann. Sper. agr.* (N.S.) **4** no. 5 pp. 869–890. Rome, 1950. (With a Summary in English.)

The author gives the results of experiments in 1949 in which a product containing 20 per cent. BHC was tested against *Dociostaurus maroccanus* (Thnb.) in heavily infested districts in southern Italy. In the first series of tests, the BHC product was mixed with soil at 4–7 per cent. and the mixture applied by hand at the rate of 1,350 lb. per acre to bands of hoppers in the second, third and fourth instars. Mortality was variable and often low at 4 per cent., good (75–100 per cent. in three days) at 5 per cent., and excellent (100 per cent. in 2–3 days) at 6–7 per cent. It is concluded that a concentration of 5 per cent. would be sufficient for practical use. The second series was carried out with mixtures of the product with an Italian bentonite. These were unsatisfactory when applied by hand, since even distribution could not be obtained, but gave good results when applied by a suitable dusting apparatus, 35 per cent. of the BHC product in bentonite giving complete mortality in two days when the dust was applied at 90 lb. per acre. In the third series, moistened bran baits containing 0·3–1·2 per cent. of the product were tested against adults at 315 lb. per acre, and the highest concentration proved satisfactory, giving 75–100 per cent. mortality in three days. The bait was more easily prepared by mixing the BHC with the water and adding this to the bran than by mixing it with the dry bran and adding the water later. From a consideration of the costs of the treatments, it is shown that the bentonite dust and the bait were more economical than the soil mixture.

PAVAN (E.). **Il contenuto in DDT, ottacloro ed esaclorocicloesano di olii [illegible] da oliveti sottoposti a trattamento antidacico.** [The DDT, Chlordane and BHC Content of Olive Oil from Trees treated against *Dacus oleae*.]—*Ann. Sper. agr.* (N.S.) **5** no. 2 pp. 289–295. 4 refs. Rome, 1951. (With a Summary in English.)

In connection with tests of BHC, DDT and chlordane against *Dacus oleae* (Gmel.) on olive in Italy in 1949, investigations were made on the insecticide residues in the oil extracted from fruits from treated trees. In five samples of

oil, two originating from trees treated with BHC, two from trees treated with DDT and one from trees treated with chlordane, the residues in parts per million were found to be 150 and 97, 92 and 156, and 123, respectively. There was some depreciation in the flavour and odour of the oil in all the samples, but no correlation between insecticide content and acidity.

D'Ausilio (M.). **Azione antidacica di due esteri fosforici.** [The Action of two Phosphorus Esters against *Dacus oleae*.]—*Ann. Sper. agr.* (N.S.) **5** no. 3 pp. 649–662, 2 graphs, 5 refs. Rome, 1951. (With a Summary in English.)

In tests in Italy in 1950 on the ability of sprays of parathion and HETP (hexaethyl tetraphosphate) to penetrate into olive fruits and kill larvae of *Dacus oleae* (Gmel.) within them, olives infested by larvae were sprayed with 0·25 per cent. of a wettable powder containing 5 per cent. parathion, 0·1 per cent. of another containing 15 per cent. parathion, 0·05 per cent. of a liquid preparation containing 10 per cent. parathion, or 0·1 per cent. HETP. When the sprays had dried, the olives were turned and sprayed on the other side. They were subsequently kept for 30 days over sand, in which the larvae that fell from them pupated. The puparia were counted, and it was calculated that the four treatments gave 41, 44, 22 and 0 per cent. mortality of the larvae, respectively, as compared with the control. In a second series of tests by the same technique, the three parathion preparations were applied at concentrations giving 0·1 and 0·2 per cent. actual parathion and HETP at 1 and 2 per cent. The puparia were counted over a period of 23 days, and it was found that the parathion treatments gave complete or almost complete mortality of the larvae, while HETP gave only 45 and 68 per cent. mortality at the two concentrations, respectively. When the olives were sprayed on one side only, to simulate conditions in the field, parathion and HETP at the higher concentrations gave 96 and 67 per cent. mortality. Dissection of some of the olives six days after treatment on both sides showed that the larvae were killed by parathion after they had become full-fed and were moving towards the surface of the fruits, so that the material did not apparently penetrate very deeply. Only living larvae were found in the olives treated with HETP, and they were deep in the fruits.

Alfaro (A.). **Comparación de insecticidas contra el escarabajo de la patata.** [Comparison of Insecticides against the Potato Beetle.]—*Bol. Pat. veg. Ent. agríc.* **17** (1949) pp. 19–26, 3 refs. Madrid, 1950.

In further experiments in Spain by a technique already noticed [*cf. R.A.E.*, A **35** 153–154], various sprays were tested for immediate and persistent effect on adults and third-instar larvae of *Leptinotarsa decemlineata* (Say) on potato. Immediate effects were estimated by mortality counts for five days after treatment, and persistent effects by similar counts among fresh insects placed on the treated plants ten days after spraying. The results are shown in numerous tables and analysed statistically.

It is concluded that a spray of 1 per cent. of a product containing 0·3 per cent. sodium fluosilicate had no significant immediate or persistent effect on the adults, and it was not tested on the larvae. One of 1 per cent. of a preparation containing 5 per cent. DDT was significantly more effective in both series of tests against the adults than 1 per cent. of a preparation containing 15 per cent. BHC (3 per cent. γ isomer) and also significantly better than a spray of 0·75 per cent. lead arsenate (30 per cent. As_2O_5). It was also significantly superior in its immediate and persistent effects on larvae to 1 and 1·25 per cent. of the BHC preparation, but there were no differences between it and lead arsenate. A spray of 1 per cent. lead arsenate was significantly better than

the BHC sprays in immediate and persistent effect on the larvae, but there were no significant differences in the effects on the adults between 0·75 per cent. lead arsenate and 1 per cent. of the BHC preparation. The stronger BHC spray was significantly more effective than the weaker one in its immediate effect on the larvae, but not in persistent effect.

GÓMEZ CLEMENTE (F.). **El mosquito de los planteles de arroz.** [The Rice Chironomid.]—*Bol. Pat. veg. Ent. agríc.* **17** (1949) pp. 27–36, 10 figs. Madrid, 1950.

Descriptions are given of the larva, pupa and adult of an unidentified Chironomid of the genus *Orthocladius* that caused severe damage in April 1948 to rice seedlings in a district of the Province of Valencia. The larvae were very numerous in infested fields, and in some of these very little of the seed had germinated, and in others, the young plants were floating on the surface of the water. Seeds that had germinated had a small, elongated mud case attached to them, containing a single larva. The ends of the roots had been attacked and in some cases partly destroyed. In experiments, good control was obtained by draining the fields and applying an emulsified solution of DDT either as a spray before the fields were re-flooded or to the water itself as it re-entered the fields. Similar attacks on rice have been observed in the Province of Seville, where BHC gave satisfactory control.

ALFARO (A.). **Orugas de *Archips* en el arbolado frutal de la ribera del Jalón.** [*Tortrix* Larvae in Orchards in the Valley of the Jalón.]—*Bol. Pat. veg. Ent. agríc.* **17** (1949) pp. 37–59, 22 figs., 5 refs. Madrid, 1950.

Studies were made in 1949 and 1950 on *Tortrix* (*Archips*) spp. attacking fruit trees, notably apple and pear, in the valley of the Jalón and its tributaries, in the Province of Saragossa. Three species were found to be distributed widely throughout the district, *T.* (*A.*) *crataegana* (Hb.), *T.* (*A.*) *xylosteana* (L.) and *T.* (*A.*) *rosana* (L.), of which the last caused much less damage than the first two. All stages of the three species are described, and their distribution in the area is discussed. They are polyphagous, and a list is given of numerous fruit and shade trees and other plants on which they were observed. The only other pest of economic importance found on apple in the area was *Parachronistis* (*Stenolechia*) *albiceps* (Zell.), which causes damage similar to that by *T. crataegana*.

In the laboratory, the larval and pupal stages of *T. crataegana* lasted 28–42 and 10–20 days, respectively. Observations in the field in the two years showed that hatching began in mid-March ; pupae were first found in mid-April in 1949 and at the beginning of May in 1950, and the adults appeared in 1949 between the end of April and the end of May. *T. xylosteana* hatched 10–15 days after *T. crataegana* and required about the same time to complete its development, and hatching of *T. rosana* occurred between the dates for the other two species. Adults of all three were abundant from late May to the end of June. The eggs were laid in batches on the trunks and branches, the numbers per batch ranging up to over 100. There was only one generation a year.

The amount of damage to the trees depends on their condition when the larvae hatch. If the flower buds have not opened (as is usually the case on apple), the larvae feed in them and prevent their development, later attacking the peduncles and young leaves, which they web together to form a mass inside which they subsequently pupate. If the flowers and foliage appear before the larvae hatch (as usually occurs on pear), the larvae confine themselves to rolling the leaves, longitudinally in the case of *T. crataegana* and *T. rosana*, and laterally in the case of *T. xylosteana*. Recently formed fruits are also attacked.

Dormant sprays applied in January–February against the eggs were not effective. Since sprays made from a wettable product containing 20 per cent. DDT (78 per cent. p, p′ isomer) gave promising results against the larvae in the laboratory, sprays of 0·5 and 1 per cent. of this product were applied to apple trees on 21st March, when the green tips of the leaves were visible, and to some of the trees again on 29th March, when the leaves had opened but the flowers had not. On the second date, an emulsion concentrate containing 10 per cent. DDT was applied at 1 per cent. to other trees. All the treatments were effective, causing the *Tortrix* larvae to leave the trees, which were free from infestation by mid-April. Further trees were sprayed after flowering with 0·5 and 1 per cent. of the DDT concentrate, 0·25, 0·5 and 1 per cent. of various wettable powders containing 20 per cent. DDT, or 0·75 per cent. lead arsenate. Lead arsenate was not very effective but the DDT sprays gave high mortality, the emulsion concentrate being the most rapid in action. Many of the larvae again left the trees before dying.

Gómez Clemente (F.). **Estudios de lucha natural contra *Earias insulana*.** [Studies on the Biological Control of *E. insulana*.]—*Bol. Pat. veg. Ent. agríc.* **17** (1949) pp. 83–95, 7 figs., 7 refs. Madrid, 1950.

The author reviews the parasites of *Earias insulana* (Boisd.) on cotton in various parts of the world and states that the larvae are parasitised by *Rogas* (*Rhogas*) *aligarhensi* Qadri in the district of Cadiz, southern Spain. The larva and adults of this Braconid are described. Its life-history was studied in the laboratory in 1948–49, and attempts were made to rear it for subsequent liberation in the field. At temperatures of 17–24·5°C. [62·6–76·1°F.], the life-cycle lasted 15–31 days, so that there might be 6–7 generations a year. The females oviposit in the host larvae, laying one egg in each, and parasitised hosts later emerge from the cotton bolls and die, the parasites pupating within the dead hosts. Young larvae were preferred for oviposition, and parasitism was highest (24 per cent.) among newly hatched individuals. The generally low rate of parasitism in the experiments was attributed to superparasitism, high mortality and low fecundity among the females. A further difficulty in the rearing of the parasite was the problem of maintaining a supply of cotton plants throughout the year to ensure an abundance of the host larvae, and tests with alternative hosts were not promising.

Gómez-Menor (J.). **La "chincheta" del almendro (*Monostira unicostata* Mulsant).** [The Almond Bug, *Monosteira unicostata*.]—*Bol. Pat. veg. Ent. agríc.* **17** (1949) pp. 97–110, 5 figs., 15 refs. Madrid, 1950.

Considerable injury is caused to almond in Spain by *Monosteira unicostata* Muls. & Rey, all stages of which are described. Feeding by this Tingid leads to the appearance of yellow spots on the leaves, which are also soiled by the excreta, and further damage is caused by the oviposition slits in the parenchyma [*cf. R.A.E.*, A **27** 359].

Ruiz Castro (A.). **La lucha contra las plagas del viñedo (su estado actual en España).** [The present Position in the Control of Pests of Grape Vines.]—*Bol. Pat. veg. Ent. agríc.* **17** (1949) pp. 111–162, 23 figs., 39 refs. Madrid, 1950.

A list is given of the numerous insects that attack grape vines in Spain, together with notes on the distribution of the more important, the damage they cause and recommendations for their control. Information on natural enemies is included in some cases.

Domínguez García-Tejero (F.). **Tentredínidos perjudiciales a la agricultura.** [Tenthredinids injurious to Agriculture.]—*Bol. Pat. veg. Ent. agríc.* **17** (1949) pp. 163–208, 24 figs., 30 refs. Madrid, 1950.

The author enumerates the Tenthredinids that injure cultivated plants in Spain, showing the plants attacked, and gives notes on their morphology, bionomics and control.

del Cañizo (J.) & Moreno (V.). **Biología y ecología de la langosta mediterránea o marroquí (*Dociostaurus maroccanus* Thunb.).** [The Biology and Ecology of the Mediterranean or Moroccan Locust, *D. maroccanus*.]—*Bol. Pat. veg. Ent. agric.* **17** (1949) pp. 209–242, 6 figs., 43 refs. Madrid, 1950.

In this paper, which is largely based on the scattered literature, the authors summarise knowledge on the life-history and ecology of *Dociostaurus maroccanus* (Thnb.), with special reference to recent research in Spain [*cf. R.A.E.*, A **34** 266, 268 ; **36** 202 ; **39** 70 ; etc.]. They discuss its bionomics and the effect of climate and vegetation on them in the first section, its phase transformations in the second, and the factors leading to the formation of swarms, including the characteristics of outbreak centres, in the third.

Gómez Clemente (F.) & Planes García (S.). **Experiencias de lucha contra el gusano de las cápsulas del algodonero *Earias insulana* (Boisduval).** [Experiments on the Control of the Cotton Bollworm, *E. insulana*.]—*Bol. Pat. veg. Ent. agríc.* **17** (1949) pp. 243–259, 6 graphs (2 fldg.). Madrid, 1950.

Laboratory and field experiments were carried out in Spain in 1948 and 1949 on the control of *Earias insulana* (Boisd.) on cotton. In the laboratory, larvae of *E. insulana* were placed on cotton bolls that had been dusted or sprayed with insecticides in order to simulate their effect on larvae migrating from one boll to another. In 1948, there was 100 per cent. mortality after 48 hours on bolls that had been dusted with sodium fluosilicate or barium fluosilicate and 88 per cent. on those dusted with a mixture of 1 per cent. each of DDT and BHC. Other materials proved inferior. In 1949, the best results, as compared with no treatment, were given by a spray of 0·33 per cent. parathion (75 per cent. mortality), one of 0·7 per cent. sodium fluosilicate with 0·5 per cent. DDT (73·5 per cent. mortality), Cotton Dust [a proprietary mixture of 5 per cent. DDT, 3 per cent. γ BHC and 40 per cent. sulphur] (73 per cent. mortality) and a spray of 1 per cent. cryolite with a wetting agent (68·5 per cent. mortality).

In field tests in various localities in 1948, dusts of sodium fluosilicate and barium fluosilicate gave the best control, the average infestation being reduced from 37·5 per cent. for no treatment to 9·05 and 14·24, respectively, on Egyptian cotton, and from 61·94 to 34·49 and 25·94 on American cotton, but sodium fluosilicate caused scorching in some fields in which humidity was excessive. Dusts of calcium arsenate and dusts and sprays of DDT or BHC proved inferior. Two series of tests were made in 1949, on irrigated Egyptian cotton and irrigated and non-irrigated American cotton in various localities. In the first series, dusts of sodium or barium fluosilicate again gave the best results, reducing the percentage infestation to about 6 as compared with nearly 40 for no treatment, and were almost as effective when diluted 1 : 1 with talc. Cryolite and calcium-arsenate dusts also gave very good control, but a chlordane dust and spray and a spray of 0·75 per cent. each of DDT and BHC were unsatisfactory. Comparable results were obtained in the second series, in which sprays of 1 per cent. sodium or barium fluosilicate were ineffective.

DEL RIVERO (J. M.). **Contribución al conocimiento de los medios de lucha contra la piral de la vid** (*Sparganothis pilleriana* **Schiff.**). [A Contribution to Knowledge of Control Measures against *S. pilleriana* on Grape Vine.]—*Bol. Pat. veg. Ent. agric.* **17** (1949) pp. 261–290, 11 figs., 2 graphs, 43 refs. Madrid, 1950.

The author reviews the literature on the control of *Sparganothis pilleriana* (Schiff.) on grape vine and describes laboratory and field experiments in Spain in 1950 on the efficacy of various insecticides in summer sprays against the larvae. In the laboratory, larvae in various instars were confined on treated shoots, and it was found that dusts of 35–75 per cent. synthetic cryolite were very effective and one of 50 per cent. barium fluosilicate (with barium sulphate as the carrier) slightly less so, while sprays of 0·05 per cent. DDT, 1 per cent. BHC (15 per cent. mixed isomers) or 0·5 per cent. cryolite (90 per cent.) were progressively less satisfactory. In the field tests, the same materials, with the omission of BHC, were applied on 22nd May, and the vines were examined on 20th June. Adult emergence had by then already occurred, so that counts of larvae could not be made, but the condition of the vines indicated that the order of efficacy of the treatments was about the same as that observed in the laboratory. A portable cage beneath which the vines can be dusted in windy weather is described.

CABIDO GARCÍA (R.). **Contribuição para o estudo da sistemática, morfologia, biologia e ecologia da cochonilha amarela** (*Chrysomphalus dictyospermi*, **Morg.**). [A Contribution to the Study of the Systematics, Morphology, Biology and Ecology of the Yellow Scale (*C. dictyospermi*).]—*Bol. Jta nac. Frutas* **9** no. 3 pp. 374–465, 34 figs., 2 maps, 48 refs. Lisbon, 1949. (With Summaries in English and French.)

The author describes all stages of *Chrysomphalus dictyospermi* (Morg.), reviews the systematic position, synonymy, world distribution and economic importance of that Coccid, and gives a list of its numerous food-plants showing which are attacked in Portugal. It is a serious pest of *Citrus* there and occurs throughout the southern half of the country. Investigations on its life-history were made in Lisbon, and the results are given in detail and compared with those recorded in the literature.

The females produced about 80–100 eggs each over a period of about a month. The crawlers hatched in a few hours, settled 2–3 hours later and moulted after 10–15 days, and total development lasted 91 days at about 18° C. [64·40° F.] and 71 days at about 21·5° C. [70·7° F.]. It is calculated that the threshold of development is 5·8° C. [42·44° F.]. There were four generations a year, lasting from mid-April to the end of July, from mid-July to the end of September, from mid-September to the end of December and from mid-November to the end of April, respectively. The influence of temperature and humidity on the distribution of *C. dictyospermi* is discussed at some length, and it is concluded that they are the main factors responsible for its virtual absence from northern Portugal.

[D'YAKONOV (N. M.).] ДЬЯКОНОВ (А. М.). **The Apricot Geometrid** (*Phyxelasis armeniaca* **D'yakonov, sp. n.**) **and Related Species** [Lepidoptera, Geometridæ]. [*In Russian.*]—*Ent. Obozr.* **30** no. 3–4 pp. 370–380, 5 figs., 8 refs. Moscow, 1949.

Apricot in the district of Ferghana (Central Asia) is attacked by a Geometrid that was formerly misidentified as *Apocheima* (*Biston*) *cinerarius* (Eschsh.) (cf. *R.A.E.*, A **2** 635, **5** 230, **30** 555). [which is a polyphagous species and prefers mulberry—cf. **22** 458], but has been found by D'yakonov to be *Phyxelasis armeniaca* Stgr. [**4** 209; **22** 459; **25** 762]. Following the receipt

from the Maritime Province of the Soviet Union of a male of a Geometrid that appeared close to the description of *P. declinata*, but differed from examples of the apricot Geometrid identified by Plotnikov, the author re-examined the latter and compared them with related species. He describes the five species that he recognises from the Soviet Union, two of which are new, and erects a new subgenus (*Metriocera*) for two of them. The species include the true *P. declinata*, *P.* (*M.*) *armeniacae*, sp.n., which is the species that attacks apricot, and *P.* (*M.*) *sinuosaria* (Leech), which is transferred from *Phigalia*, is known from the Maritime Province and is a pest of fruit trees in Japan [*cf.* **11** 425 ; **27** 668]. The larvae of *P. armeniacae* feed on the leaves, buds and flowers of apricot, causing serious injury in some years, and have not been observed on any other plant. They pupate in the soil in the second half of April, but the adults do not emerge until the onset of cold weather in the following November–February. The species is recorded from Ferghana and from Leninabad (Central Asia).

[Rodendorf (B. B.).] **Родендорф (Б. Б.). A new Species of Tachinid of the Genus *Centeter* (Diptera, Larvivoridae)—a Parasite of *Aserica orientalis*.** [*In Russian.*]—*Ent. Obozr.* **30** no. 3–4 pp. 418–419. Moscow, 1949.

Tachinid parasites of *Aserica* (*Maladera*) *orientalis* (Motsch.) sent to the author from the Maritime Province of the Soviet Union included a species of *Centeter* here described from adults of both sexes as *C. ussuriensis*, sp.n. Characters distinguishing it from other species of the genus are shown in a key.

[Paĭkin (D. M.).] **Пайкин (Д. М.). The Result of the Testing of Thiophos for the Control of the Noxious Little Tortoise.** [*In Russian.*]—*Dokl. vsesoyuz. Akad. sel.-khoz. Nauk Lenina* **15** no. 7 pp. 33–35. Moscow, 1950.

In laboratory experiments in 1949 in the Province of Krasnodar (northern Caucasus), complete mortality of newly emerged adults of *Eurygaster integriceps* Put., which are resistant to DDT and other insecticides, was obtained in 24 hours by dusting the bugs with thiophos, a preparation of 1 per cent. parathion in talc. In field tests in small plots of autumn-sown wheat shortly before harvest and in plots of stubble, all the bugs were killed in 1, 2, 2 and 3 days by dusts of 1, 0·5, 0·4 and 0·3 per cent. parathion at 27 lb. per acre, respectively, and in 2, 3, 4 and 4 days when the rate was halved. Special tests showed that the dust did not injure wheat, millet, maize, pumpkins, beans and young shoots of apple, but scorched the leaves of cucumbers. The dust was much less effective when dispersed in water, and it rapidly lost its toxicity in the field, owing mainly to the effects of temperature. It also proved toxic in the laboratory to several other insects, which are enumerated. Subsequent laboratory tests, of which no details are given, showed that a 5 per cent. dust of methyl-parathion was as effective against *E. integriceps* as the parathion dust itself, and that the O,O-dipropyl, O,O-diisopropyl and O-ethyl O-p-nitrophenyl thiophosphates also possessed sufficient toxicity to be used as agricultural insecticides.

[Lapina (V. F.).] **Лапина (В. Ф.). Contribution to the Question of the Effect of Parasites on the Dynamics of the Population of the Hessian Fly (*Mayetiola destructor* Say).** [*In Russian.*]—*Zool. Zh.* **27** pt. 4 pp. 329–334, 4 graphs, 11 refs. Moscow, 1948.

The results are given of observations in the Province of Voronezh in 1938 and 1939 on parasites of *Mayetiola destructor* (Say) on spring-sown and winter wheat. The fly was abundant in 1938 and scarce in 1939. The percentages parasitised in samples of various stages obtained from winter and spring-sown wheat in May–June 1938 were 67·27 and 82·93, respectively, and the percentages

in samples of puparia obtained in April–July 1939 were 50·6 and 66·6. The parasites reared in 1938 comprised *Merisus destructor* (Say), *Pleurotropis metallica* (Nees) and *Ceraphron* sp., which were abundant, and *Eupteromalus micropterus* (Lind.), *Eupelmus atropurpureus* Dalm., *Callitula bicolor* Spin., *Meraporus crassicornis* Kurd. and *Tetrastichus carinatus* Forbes, which were scarce. Those reared in 1939 comprised the first five of these and also *Eupelmus microzonus* Först., *Tetrastichus* sp., *Platygaster zosine* Wlk., *P. hiemalis* Forbes and a species cited as *P. minutus* [presumably *P. minutula* D.T. (*minutus* Lind.), which Gahan (*R.A.E.*, A **22** 203) considered to be a synonym of *P. hiemalis*]. The author states that adults of this species, unlike those of the other species of *Platygaster*, emerged before the adults of *Mayetiola* and concludes that it and the three parasites that were abundant in 1938 are those likely to be of importance in reducing the numbers of the fly.

[Sorokin (S. V.).] **Сорокин (С. В.). The Dynamics of Cereal Mites in Hay.** [*In Russian.*]—*Zool. Zh.* **27** pt. 6 pp. 487–494, 2 refs. Moscow, 1948.

Examination of samples of hay from stacks in the Provinces of Kirov and Vologda revealed the presence of several species of grain mites of which *Tyroglyphus farinae* (Deg.) and *Tyrophagus tenuiclavus* Zkhv. were much the most abundant. These two species were prevalent in fresh stacks and stacks made one or two years before, whereas some of the less numerous species occurred only in stacks of particular ages. Observations indicated that the mites migrate to the hay from neighbouring fields or farm biotopes and increase in it, and that the species, such as *Tyroglyphus farinae*, that are ecologically adaptable survive when the hay is taken into lofts.

[Pavlov (I. F.).] **Павлов (И. Ф.). The Poppy-root Weevil (*Stenocarus fuliginosus* Marsh.).** [*In Russian.*]—*Zool. Zh.* **28** pt. 3 pp. 243–252, 5 refs. Moscow, 1949.

Plantings of poppy in the Province of Voronezh are damaged by *Stenocarus fuliginosus* (Marsh.), and an account is given of observations on its bionomics in 1937–39, much of the information being similar to that already noticed [*R.A.E.*, A **24** 703]. At a temperature of 18–20°C. [64·4–68°F.], the overwintered adults survived without food for 12–16 days. Most of the eggs were laid in May, on the leaves, stems or pedicels or on the soil near the plants. The larvae hatched in 7–9 days, fed for 20–30 days on the roots and then made earthen cells, usually at a distance of about 2 ins. from the plants, in which they pupated 5–8 days later. The pupal stage lasted 15–20 days, and the adult weevils appeared in July and August, later returning to the soil for hibernation.

Most of the larvae were found at a depth of about an inch. Those in the first and second instars survived without food for only 2–3 and 4–7 days, respectively, but older ones survived for 15–20 days, and the distances covered by them increased from about 4 ins. for the first instar to about 12 ins. for the third and fourth. Accordingly, young larvae died after the plants were thinned, but older ones migrated to the remaining plants. To prevent this, thinning should be carried out before 5th–8th June, when most of the larvae are still in the first two instars. Feeding larvae were not affected by high or low humidity of the air or soil, but many larvae, pupae and adults in their earthen cells were found to be dead in August 1938, when the soil was extremely dry. The larvae were considerably reduced in abundance by Carabids, ten species of which were encountered. Since the overwintered adults of *S. fuliginosus* do not fly during the first 10–15 days after they leave the soil, maximum infestation occurred in poppy fields situated close to those of the preceding year, and decreased in proportion as the distance between the old and new fields increased.

In dusting experiments against the adults in May 1938, 65, 39 and 22 per cent. mortality was given in a week by calcium arsenate at 9 lb. per acre, sodium fluosilicate at 10·8 lb. per acre, mixed with ash (1:3), and a preparation of anabasine sulphate. Similar results were obtained with the first two in 1939.

HARRIES (F. H.) & DOUGLASS (J. R.). **Bionomic Studies on the Beet Leafhopper.**– *Ecol. Monogr.* **18** pp. 45–79, 18 figs., 95 refs. Durham, N.C., 1948.

An account is given of detailed laboratory studies in southern Idaho in 1932–37 on the effect of environmental factors, mainly temperature and humidity, on *Circulifer* (*Eutettix*) *tenellus* (Baker), the vector of the virus of curly top, and of studies on its seasonal development and abundance in the field during 1934–35. The following is largely taken from the authors' summary. The average duration of the egg stage ranged from 5·5 days at 100°F. to 43·8 at 60 F., and that of the nymphal stage on beet from 13 days at 95°F. to 75·4 at 65 F. Males developed rather more rapidly than females. The minimum effective temperature for development appeared to lie between 50 and 55°F. The rate of development of both eggs and nymphs was closely proportional to the temperature between 65 and 95 F., and in this range required thermal increments, summed between 58 and 95 F., of about 200 and 450 day-degrees, respectively. The weight of the nymphs approximately doubled in each of the five instars and increased from about 0·04 mg. at hatching to about 0·9–1 mg. just before the final moult. Development was more rapid when the eggs and nymphs were exposed daily to alternating high and low temperatures and at naturally varying temperatures than at equivalent constant temperatures (*R.A.E.*, A **32** 116; **33** 220). Three generations developed in each of the years 1934 and 1935, and studies of the annual temperature accumulations over a 10-year period indicated that there are usually three generations a year in southern Idaho, with the last one sometimes maturing rather late in the autumn and possibly limited in size by low temperatures. Migration to the cultivated areas in May or June is at first slow, but becomes more rapid, reaching a peak in 1–3 weeks according to the temperature in the breeding areas. There was a close correlation between the dates of the beginning of migration in different years and the recorded temperature increments (*cf.* **34** 353). In years in which high spring temperatures caused early migration, curly-top injury to sugar-beet was usually severe, whereas beet yields were generally good when low temperatures delayed migration.

The development of the eggs was apparently not affected by humidity, but that of the nymphs was slightly retarded by high humidities at unfavourably high temperatures; neither stage was affected by light, but it stimulated hatching when embryonic development was complete. There was considerable variation in the rate of development of the nymphs on different food-plants. Mortality of eggs and nymphs increased at both temperature extremes for development, and that of the nymphs also with increased humidity. At moderate temperatures (40 and 50°F.), relative humidities of 30 and 80 per cent. had no appreciable effect on mortality in either stage. Advanced embryos and the smaller nymphs were the most susceptible to cold.

Seasonal colour forms in the adults [*cf.* **25** 756] are determined by temperature, which also affects size and weight: adults maturing in autumn and spring were generally slightly larger than those appearing in summer, and in the laboratory adult weight increased with successively lower temperatures. The sexes were about equally numerous at all temperatures and humidities. Pairing occurred early in the adult stage and was not observed after ovarian development was complete; unfertilised females

oviposited normally, but the eggs did not hatch. The preoviposition period lasted 4–6 days in summer and 4–6 months in winter, and was apparently governed largely by the maximum temperatures. It was little affected by humidity. Ovarian development in the overwintering generation was suspended in autumn, but was resumed after exposure to greater cold. Oviposition began at about 50°F. and reached a peak at 90–100°F., and its rate was not affected by light or humidity or accelerated by exposure to varying temperatures. Most of the overwintered females deposited 300–400 eggs each, but one laid 675.

Adults survived longest at 50–60°F., and the survival period decreased as temperatures rose to 110–115°F., at which it occupied only a few days, or fell to 30°F., at which feeding ceased. Adults survived longer on flixweed (*Sophia parviflora*) than on beet, and survived without water or contact moisture for only a short period, the length of which was apparently determined by their rate of water loss. It is thought that many otherwise unfavourable food-plants may favour survival by providing moisture.

Winter temperatures are seldom low enough to cause much mortality of the overwintering females, and the effects of periods of extreme cold would probably be mitigated by short temperature increases during the day. Under experimental conditions, exposure for 5–10 minutes daily to higher temperatures counteracted the effects of intense cold, so that the survival period at 25–10°F. was about the same as at 30°F., death apparently resulting mainly from desiccation. Extended cold periods that prevent feeding or absorption of moisture would be unfavourable for survival.

Studies of overwintering adults in the desert breeding area showed a significant increase in mortality following a cold period in January when the temperature at the soil surface approached 0°F. for two nights in succession.

Yust (H. R.) & Shelden (F. F.). **A Study of the Physiology of Resistance to Hydrocyanic Acid in the California Red Scale.**—*Ann. ent. Soc. Amer.* **45** no. 2 pp. 220–228, 14 refs. Columbus, Ohio, 1952.

The following is based on the authors' summary. In experiments in California on the nature of the physiological basis for variations in the resistance of different strains of *Aonidiella aurantii* (Mask.) to fumigation with hydrocyanic acid gas, non-resistant, resistant and super-resistant strains of the scale [*cf. R.A.E.*, A **40** 101] showed no differences in oxygen consumption under normal conditions, but after exposure to HCN, the oxygen consumption was depressed, the degree of depression being greatest in the non-resistant, intermediate in the resistant and least in the super-resistant strain. The three strains showed the same relative resistance to hydrogen sulphide as to HCN. After exposure to an atmosphere of almost pure nitrogen, mortality was highest in the strain showing least susceptibility to HCN and lowest in that most sensitive to it.

These results are taken as strong presumptive evidence that susceptibility to HCN is associated with a high degree of dependence on enzyme systems containing heavy metals for tissue oxygen requirements, and resistance to HCN with a high degree of dependence on metal-free autoxidisable respiratory enzymes, possibly of the flavoprotein type.

Rodriguez (J. G.) & Rodriguez (L. D.). **The Relation between Minerals, B-complex Vitamins and Mite Populations in Tomato Foliage.**—*Ann. ent. Soc. Amer.* **45** no. 2 pp. 331–338, 2 graphs, 14 refs. Columbus, Ohio, 1952.

The following is based on the authors' summary of this account of experiments on the effect of supplying different nutrients to tomato plants on the populations

of *Tetranychus bimaculatus* Harvey developing on them [*cf.* *R.A.E.*, A **40** 386]. Foliage from plants grown in nutrient culture at varied levels of nitrogen and phosphorus supply was analysed for absorbed major and minor elements and for the B-complex vitamins thiamine, riboflavin and niacin, and populations of the mite that developed from females isolated on the plants were determined. It was found that increasing the nitrogen supply tended to increase the content of the three vitamins in the foliage, significantly in the case of riboflavin and niacin. About twice as much niacin was elaborated when nitrogen was increased from 100 or 200 to 800 parts per million. Riboflavin and niacin were elaborated concomitantly with each other and with absorbed nitrogen and phosphorus.

The relations of riboflavin and niacin to mite development appeared inconclusive. Riboflavin was negatively but not significantly correlated with population in the nitrogen study, and niacin was significantly correlated with population, negatively in the nitrogen and positively in the phosphorus study. It is suggested that a slightly different range of niacin elaboration in the two cases may have been responsible for the two types of correlation demonstrated.

BAKER (E. W.) & WHARTON (G. W.). **An Introduction to Acarology.**—8½ × 5½ ins., xiii + 465 pp., col. frontis., 2 pls., 377 figs., refs. New York, N.Y., Macmillan Co., 1952. Price $10.

The introductory chapter of this monograph consists of an account of the morphology and anatomy of the Acarina, together with brief notes on the collection and preparation of material for study. The remaining chapters contain keys differentiating all the 228 families and descriptions of them, a list of genera in each family and their type species, brief indications of distribution and habits, notes on importance in agriculture or public health, if any, and references to relevant literature.

Names are assigned to previously unnamed new species that were the types of three genera proposed by Trägårdh.

WEST (A. S.). **Notes on Leconte's Sawfly.**—*Canad. Ent.* **84** no. 2 pp. 59–61, 2 figs., 3 refs. Ottawa, 1952.

Neodiprion lecontei (Fitch) is a common pest of pines in Ontario. Red pine (*Pinus resinosa*) is the usual food-plant, but jack pine (*P. banksiana*) is sometimes attacked. In 1946, evidence was obtained that needles of *P. banksiana* are sometimes selected for oviposition, even where foliage of *P. resinosa* is plentiful. It has been considered that eggs are not laid on white pine (*P. strobus*) although the needles are eaten by larvae that migrate to it [*cf.* *R.A.E.*, A **9** 267], but the appearance and relative position of infested trees in a mixed plantation of *P. resinosa* and *P. strobus* in 1946 suggested that oviposition had taken place on both species.

REEKS (W. A.). **Establishment of *Exenterus* spp. (Hymenoptera : Ichneumonidae), Parasites of the European Spruce Sawfly, near Points of Introduction.**—*Canad. Ent.* **84** no. 3 pp. 76–86, 1 fig., 12 refs. Ottawa, 1952.

Parasites introduced into eastern Canada for the control of the European spruce sawfly, *Gilpinia hercyniae* (Htg.), during the decade prior to 1940 were of assistance in ending the outbreak, though it was controlled principally by a virus disease [*cf.* *R.A.E.*, A **33** 398], and some have been of value subsequently in maintaining populations of the sawfly at a low level. At least seven species of introduced parasites have been recovered, and the author discusses those

of the genus *Exenterus* that became established at Young's Brook, New Brunswick, and in the central Gaspé Peninsula, Quebec. There has been some confusion regarding the taxonomy of the group [*cf.* **29** 294 ; **32** 149], but from studies of parasites recovered from the field and others retained at the time of liberation it is concluded that the colonies released in New Brunswick in 1936 and 1937 as *E. abruptorius* (Thnb.) and *E. tricolor* Roman, respectively, were correctly identified, but that those liberated in the same two years as *E. adspersus* Htg. [*cf.* **26** 487 : **29** 637] and in 1937 as *Exenterus* sp. [*cf.* **28** 515] each comprised the three species, *E. claripennis* Thoms., *E. amictorius* (Panz.) (*marginatorius* (F.)) and *E. vellicatus* Cushm., and that the species liberated in the Gaspé Peninsula in 1933 as *E. marginatorius* [*cf.* **25** 13] was *E. claripennis*. Although *E. claripennis*, *E. amictorius*, *E. vellicatus* and *E. tricolor* have all been recovered in eastern Canada, only the first three were found at Young's Brook. The seasonal history of *E. claripennis* there is briefly outlined [*cf.* **25** 14 ; **31** 133] ; that of the other two species appears from limited data to be similar.

Parasite populations were determined at Young's Brook from the numbers of parasitised sixth-instar larvae that fell from spruce trees on to trays beneath them during 1937–41 and the numbers of parasitised cocoons collected from unit areas of the forest floor during 1936–50. Peak numbers of host larvae and cocoons were reached in 1937 and 1938, respectively, and numbers of cocoons were low after 1940. The parasites reached peak numbers in the host larvae and cocoons in 1939 and 1938, respectively, when the host population was already declining. *E. claripennis* and *E. amictorius*, of which the former was much the more numerous, were the only species recovered before 1941, when host populations fell to less than one per 4 sq. ft., and their establishment was associated with high but steadily declining populations. No parasites were recovered between 1941 and 1945, after which *E. vellicatus* was virtually the only species present ; it occurred in very small numbers, but can evidently become established and maintain itself when host populations are low.

The factors influencing the establishment of the parasites are discussed. The most important of those favouring it was the high biotic potential of the parasites, which appears to be at least twice that of their host. Others were their preference for *G. hercyniae* and their rapid dispersal rate. The most important limiting factor was the virus disease of the host larvae, which reduced the number of hosts available and killed parasitised individuals. After 1938, the disease destroyed most of the host larvae during the periods in which the second-generation parasite adults were present, but the parasites escaped extermination owing to some of the population being in diapause. Mammal predators of the hosts may also have caused some reduction in parasite numbers [*cf.* **38** 183]. A few of the parasites develop on host larvae in the fourth and fifth instars, and many of these are liable to be sloughed off when the hosts moult.

CLARK (J.). **The Spruce Bud Midge, *Rhabdophaga swainei* Felt (Cecidomyiidae : Diptera).**—*Canad. Ent.* **84** no. 3 pp. 87–89, 2 figs., 2 refs. Ottawa, 1952.

Many buds on young spruce trees (*Picea* spp.) at Fredericton, New Brunswick, were found in May 1948 to be malformed as a result of attack by *Rhabdophaga swainei* Felt. Infested buds were enlarged, the lateral scales reflexed and the apices open and rosette-like. Infestation was commonest on *P. glauca* and *P. rubra* (*rubens*) but also occurred on *P. abies* and *P. pungens* ; *P. mariana* appeared to be immune.

Notes are given on the bionomics of the Cecidomyiid, based on field and laboratory observations in 1948–49, together with brief descriptions of all

stages. Eggs were deposited between the resinous bud scales or the young needles of the developing shoots between 5th and 26th May, during which time buds of *P. glauca* opened and the shoots elongated 1–3 ins. Of five twigs examined, three showed one egg each, one two, and one a cluster of seven ; a dissected female contained nine fully formed eggs. Ovipositing females visited several shoots, inserting the ovipositor in each, and were most active during sunny periods. The larvae hatched after about five days in the laboratory and entered the tips of the shoots through the base of a young needle ; early feeding is evidently limited, since the shoot completes its development and the buds appear normal until late autumn or early winter. In late November, galled buds contained larvae that were almost fully grown but dormant, and on 29th May 1948 and 5th May 1949, only pupae were present. Towards late April, the buds become rosette-like, thus facilitating emergence of the adults, which was observed in early June in 1948, though adults were in flight before that period, and in May in 1949. There was one generation a year. A parasite identified as *Amblymerus* sp. was commonly found within the galls.

R. swainei is common in central New Brunswick and is present at places throughout the Province. Galled buds were also observed on *P. glauca* in Prince Edward Island in 1948 and in Newfoundland in 1948–49. Galls are commonest on the sunny sides and tops of open-grown trees 6–12 ft. high, and terminal buds are frequently attacked. The growth of infested buds is completely arrested and their replacement by lateral ones results in bushy growth and, in some cases, the development of multiple leaders or the formation of a crook, which, however, is probably overgrown before the tree is large enough for felling.

JACOBSON (L. A.) & FARSTAD (C. W.). **Effect of Time of Seeding Apex Wheat on Infestation and Sex Ratio of the Wheat Stem Sawfly,** *Cephus cinctus* **Nort. (Hymenoptera : Cephidae).**—*Canad. Ent.* **84** no. 3 pp. 90–92, 4 refs. Ottawa, 1952.

A field experiment to provide additional information on the effect of date of sowing on infestation of wheat by *Cephus cinctus* Nort. was carried out in Alberta in 1945, when to delay seeding until after 15th May was a recommended preventive measure. Wheat was sown at intervals of about five days from 30th April to 22nd May and then daily until 9th June on summer fallow adjoining wheat stubble that had been uniformly infested in 1944. Samples were taken for the determination of the numbers of eggs per stem and of infested and cut stems, and the stubs were retained in the laboratory after harvest for the emergence of adults. It was found that all the stems of the earliest sown wheat became infested, but the percentage of infestation fell to 95 in that sown on 16th May and to 8 in that sown on 31st May ; the corresponding figures for the percentages of stems cut were 61, 74 and 2. Previous observations had shown that populations of the sawfly were lower than expected in years following infestation of late-sown wheat. In the present work, it was found that the percentage of males increased progressively from about 40 for wheat sown at the end of April to over 70 for that sown at the end of May, and anomalous sex ratios have also been observed in other studies [*R.A.E.*, A **27** 176]. Unfertilised females produce a high proportion of males except in limited areas in which a parthenogenetic race exists [*loc. cit.*]. Since the males usually emerge before the females and the latter predominate towards the end of the flight, it is probable that some of the late females lay infertile eggs, either because they emerge after the males have disappeared or because they contain an insufficient supply of spermatozoa to fertilise all their eggs.

VAN DER LAAN (P. A.). **Over de bestrijding van het katjang-vliegje op kedelee met insecticiden.** The chemical Control of the Bean Fly (*Melanagromyza phaseoli*) on Soy Beans. *Meded. alg. Proefst. Landb.* no. 98, 28 pp., 6 figs., 24 refs. Buitenzorg, 1949. (With a Summary in English.) Also in *Landbouw* **22** no. 3–4. Buitenzorg, 1950.

The author summarises van der Goot's account of the morphology, bionomics, food-plants and control of *Melanagromyza* (*Agromyza*) *phaseoli* (Coq.) in Java (*R.A.E.*, A **19** 255) and gives a table showing the countries in which it occurs and its food-plants in each of them. It causes serious damage to young soy-bean plants in some districts of Java, ovipositing in the seed leaves soon after they appear. Since chemical control of this Agromyzid has proved successful in Australia (**36** 46, etc.), experiments were made in 1948-49 on soy bean, and accounts are given of numerous field tests in which dusts and sprays of DDT, BHC, derris or toxaphene were used. Treatment with wettable-powder sprays containing 0·05 per cent. technical DDT or BHC (about 15 per cent. γ isomer) or dusts of 5 per cent. DDT or BHC at rates of 13·5–18 lb. per acre resulted in marked reductions in infestation and increases in yield ranging up to about 50 per cent. or more. Treatments should be begun 5–6 days after the date of sowing, before signs of injury appear, and repeated 3–7 times on alternate days according to the severity of the infestation. In small-scale tests, three applications of a spray containing 0·12 per cent. toxaphene or a 10 per cent. toxaphene dust gave rather better control than seven treatments with DDT. Derris proved unsatisfactory.

VAN DER LAAN (P. A.). **Life History and Control of the Rice Seedling Fly.** — *Contr. gen. agric. Res. Sta. Bogor* no. 118, 15 pp., 7 figs., 9 refs. Bogor, 1951. (With a Summary in Indonesian.)

The author discusses the distribution of *Atherigona* spp. and states that *A. exigua* Stein is a serious pest of the seedlings and young plants of dry-land rice in Java, where it also attacks maize. Studies on its bionomics showed that the eggs of this Anthomyiid are usually laid on the undersides of the youngest leaves, and up to 35 were found on one leaf. The egg, larval and pupal stages lasted 1·5–2, 17 and 7 days, respectively. The larvae normally hatch at night, and those that hatch during the day often die immediately through lack of water. They appear to need much moisture for development, and this accounts for the serious nature of the infestation in the wet season as compared with the dry one. The larvae feed in the central shoots of the rice, causing them to wilt within a few days, and pupate in the soil near the plant. In the laboratory the adults survived for 13–23 days. Pairing took place a week after emergence and the females laid 9–18 eggs each in one or two days. There was little difference in the rate of development on rice and maize and ovipositing females showed no preference between the two plants.

In experiments on control during the wet season of 1948–49, seven daily applications of various insecticides were made from the time that the rice seedlings first appeared. Proprietary sprays and dusts containing DDT were ineffective, but a dust containing 5 per cent. BHC reduced the infestation from 48 to 17 per cent. and was significantly better than sprays of BHC or toxaphene. In further tests with BHC dusts, inferior results were given by reducing the concentration to below 5 per cent., or the number of applications to below 6–8 within the first 10–12 days. The yield of unhusked rice from plots dusted with 5 per cent. BHC was two or more times as great as that from untreated ones.

VAN DER LAAN (P. A.) & ANKERSMIT (G. W.). **Chemical Control of the *Arachis* Leaf Miner (*Stomopteryx subsecivella* Zell.).**—*Contr. gen. agric. Res. Sta. Bogor* no. 119, 13 pp., 3 figs., 6 refs. Bogor, 1951. (With a Summary in Indonesian.)

The Gelechiid, *Stomopteryx subsecivella* (Zell.), of which *S.* (*Aproaerema*) *nerteria* (Meyr.) [*R.A.E.*, A **9** 272; **10** 375; **16** 190; **30** 470, 559] is a synonym, causes serious damage to groundnuts and sometimes to soy beans in Java and Sumatra. Observations on its bionomics in Java showed that the egg, larval and pupal stages last 4, 22 and 7 days, respectively. The eggs are laid singly on the upper part of the food-plant, and the larva feeds in a short blister-like mine in the leaf for about eight days, after which it emerges and webs several leaflets together, forming a shelter in which it completes its development and pupates. Several larvae sometimes attack the same leaflet, and when the infestation is heavy, the plant is retarded in growth and sometimes in the dry season even killed. Serious outbreaks are most frequent when groundnuts and soy beans are sown several times in succession. Experiments showed that groundnuts are attacked at any stage of their growth, but young plants were the most susceptible. The most important parasite observed near Bogor was *Apanteles* sp., which sometimes parasitised up to 60 per cent. of the larvae.

Experiments on the control of the larvae on groundnuts were begun in December 1948, when a spray of 0·05 per cent. DDT gave complete control. A dust of 5 per cent. BHC gave a complete mortality of larvae in all stages of development and also killed 32 per cent. of the pupae. In a further experiment, a dust of 2·5 per cent. BHC killed 98 per cent. of the larvae, but a derris dust containing 2 per cent. rotenone killed only 25 per cent. In a third test, the mortality percentages were 89, 91 and 68 for dusts of 2·5 per cent. BHC and two proprietary preparations each containing 5 per cent. DDT. When heavily infested groundnuts were dusted with BHC in the field, mortality reached a maximum in two days and then declined slowly. In a comparison of the yields from dusted and undusted plots, the yield of pods was about doubled by eight weekly or four fortnightly applications of 5 per cent. DDT or BHC beginning 26 days after sowing. DDT was more effective than BHC, but all treatments gave nearly complete control of the larvae. As the later applications had little effect, it is thought that one or two treatments, applied as soon as mines appear on the leaves, should give complete control. In a subsidiary test, sprays of 0·05 per cent. DDT and 0·12 per cent. toxaphene and a dust of 10 per cent. toxaphene all gave satisfactory reductions in the numbers of larvae and pupae on soy beans.

BÖHM (H.) & PSCHORN-WALCHER (H.). **Biologie und Bekämpfung von *Hyphantria cunea* Drury (Lepidopt., Arctiidae—Weisser Bärenspinner).** [The Bionomics and Control of *H. cunea*.]—*Pflanzenschutzberichte* **9** pt. 7-10 pp. 105–150, 15 figs., 1 diagr., 3 graphs, 12 refs. Vienna, 1952. (With a Summary in English.)

The investigations on the bionomics and control of *Hyphantria cunea* (Dru.) begun in Austria in 1951 [*R.A.E.*, A **40** 376] were continued and extended in 1952, when this Arctiid spread further to the west in Burgenland and Lower Austria, covering average distances of about 6–16 miles. Its distribution at the end of the year is shown on a map. Plants of 94 species, a list of which is given, were attacked, and since some appeared to be preferred to others, rearing experiments were carried out. These and field observations showed that oviposition was heaviest, larval development most rapid and mortality lowest on 16 fruit and forest trees. Development was slower on a second

group, and mortality high, particularly among young larvae, on a third. Plants in the third group were attacked in the field only by larvae in the final instars, when the preferred food-plants had been defoliated.

Two generations again developed in the year. The second was not generally more numerous than the first and was far less injurious than in 1951. Adults emerged from the overwintered pupae in late April, when the daily average temperature was 18–19°C. [64·4–66·2°F.] and the maximum 27°C. [80·6°F.], and the main flight occurred on 5th–10th May. In the laboratory, no pupae gave rise to adults when kept at 0 or 5–8°C. [32 or 41–46·4°F.], but all did so when transferred to 20 or 30°C. [68 or 86°F.]. Only about 2 per cent. of the adults were of the spotted form (typical *cunea*) [*cf.* **38** 162], and almost all these were males. The remaining adults were of the white form (*textor* Harr.), and among these, males and females were equally numerous. The first-generation adults appeared in late July and the first half of August, and the typical form was still more rare. Some field-collected pupae of the overwintered and first generations entered a diapause and had not given rise to adults at the time of writing, and a further 10 per cent. were dead or parasitised. Females survived for 8–10 days and males for six at 22°C. [71·6°F.] and 60 per cent. relative humidity.

Oviposition occurred soon after pairing and, unless disturbed, the females normally laid all their eggs in a single cluster averaging some 600–800. The eggs are usually affixed to the undersides of the leaves and are not easily dislodged by rain. At 60 per cent. relative humidity in the laboratory, the egg stage lasted 15–18 days at 10°C. [50°F.] but 70 per cent. of the first-instar larvae died at that temperature ; it lasted 6–7 days at 20°C., and mortality was slight. The eggs hatched in three weeks in the field in May, at an average daily temperature of 10·2°C. [50·36°F.], with minima on some days near freezing point, and it is considered that larval mortality was also at least 70 per cent. Eggs laid at the end of May hatched in 8 days, and those of the second generation in 5–6 days at average daily temperatures of 18–25°C. [64·4–77°F.]. During the first five instars, the larvae formed communal webs and attempts to rear them singly failed. Larval development was completed in 30–36 days at 20–25°C. in the laboratory and averaged 43·8 and 50·2 days in the field for the first and second generations, respectively. A third generation was reared in the laboratory, but was not numerous, and it is considered probable that a partial third generation might develop in the field in eastern Austria under favourable conditions. The pupal stage lasted for an average of 10–14 days in the field in July at about 22°C. The larvae normally passed through seven instars, and a few that pupated prematurely after the sixth instar mostly gave rise to abnormal adults of low egg-laying capacity.

The larvae were destroyed by various predators, including Coccinellid and Syrphid larvae, and were parasitised by *Pimpla turionellae* (L.), *Paniscus testaceus* Grav., *Pyracmon austriacus* Tscheck, *Ichneumon* sp., *Psychophagus omnivorus* (Wlk.), *Compsilura concinnata* (Mg.), *Tachina larvarum* (L.) and *Sarcophaga carnaria* (L.), but little control was afforded. In many cases, both host and parasite died before the latter was fully-grown, indicating incomplete adaptation.

In laboratory tests on control, larvae in the different instars were dusted or sprayed with various proprietary materials, those in the fifth and earlier instars being treated in the webbing. DDT spray and dust gave complete control of the first three instars only, γ BHC alone or in combination with DDT in dusts and sprays was satisfactory against the first five, and a parathion spray and E 605 Staub [a dust of 2 per cent. methyl-parathion] gave complete mortality of all instars in a week. Similar results were obtained in field tests except that the parathion spray and methyl-parathion dust gave poor control

of larvae in the sixth and seventh instars, many of which left the trees as soon as treatment began. Fogs of DDT and BHC alone or in combination were also tested in the field and gave good control of larvae in the first five instars. Large-scale control measures against both generations were organised during the year in the heavily infested area. Sprays of DDT and γ BHC in combination were mainly used, with some sprays of DDT alone. They were applied soon after hatching and gave satisfactory results. Their use against the first generation is held to have contributed to the small size of the second.

BÖHM (O.). **Der "falsche Kohlerdfloh"** (*Haltica oleracea* **L.) als Schädling an Wein.** [*H. oleracea* as a Pest of Vines.]—*Pflanzenschutzberichte* **9** pt. 7–10 pp. 153–154, 4 refs. Vienna, 1952. (With a Summary in English.)

Injury to the leaves of grape vines in Austria by adults of *Haltica oleracea* (L.), which had been reported in 1931 [*R.A.E.*, A **20** 238], was again observed in 1952. The infestation apparently resulted from the presence in the vineyard of weeds on which the flea-beetle normally feeds. Sprays containing DDT, BHC or parathion at the concentrations normally used against other insects on vines gave complete control.

BENNETT (S. H.). **Experiments with systemic Insecticides against the Green Apple Aphis**—*Aphis pomi.*—*Rep. agric. hort. Res. Sta. Bristol 1949* pp. 90–96, 6 refs. Long Ashton [1950].

In further tests of systemic insecticides [*cf. R.A.E.*, A **37** 483, 487–488], designed to determine their effectiveness in perennial woody plants, apple seedlings grown in pots in an unheated greenhouse were infested on 13th April 1949 with *Aphis pomi* Deg., and the soil in which they were grown was treated on 21st April with sodium selenate, bis(dimethylamino)-8-hydroxyquinolylphosphine oxide, Pestox 3 (a commercial preparation estimated to contain 75–80 per cent. schradan), bis(2-fluoroethoxy)methane or bis(dimethylamino)-fluorophosphine oxide, applied in water at rates of 50–500 parts per million of the average weight of moist soil in the pot or similarly with schradan at 500 p.p.m. Daily counts of fallen dead Aphids were made from 22nd April to 3rd May, and the plants in some of the series were reinfested 12–42 days after treatment and examined subsequently each day for a week.

All but the first two compounds showed persistent systemic toxicity, mortality being complete in 3–4 days for Pestox and the methane at 50 p.p.m. and in one day for schradan, 42 days after treatment, and in one day for the fluorophosphine oxide at 125 p.p.m., 21 days after treatment. The fluorine and selenium compounds proved phytotoxic, and the fluorophosphine oxide killed the plants at 500 p.p.m. and caused a marginal scorch at 50 p.p.m.

In tests in which the leaves and stems of plants on which the Aphid had become well established were dipped in 1, 0·1 and 0·01 per cent. aqueous solutions of the six materials with a wetting agent, in order to test the contact effect, all the insecticides gave complete or almost complete mortality at 1 per cent. and all but sodium selenate and bis(dimethylamino)hydroxyquinolylphosphine oxide at 0·1 per cent., but only schradan, the methane and the fluorophosphine oxide gave high kills at 0·01 per cent. Reinfestation of the plants 1–34 days after treatment showed that schradan and Pestox had the greatest persistent systemic toxicity, each giving complete kill in three days or less 34 days after application at 1 per cent. and 21 days after application at 0·1 per cent. The fluorophosphine oxide at 1 per cent. showed fairly strong persistence for 12 days, and the other materials none.

KEARNS (H. G. H.) & MORGAN (N. G.). **A Note on the Control of Leaf Curling Plum Aphid by a D.D.T. Emulsion.**—*Rep. agric. hort. Res. Sta. Bristol 1950* pp. 123–124. Long Ashton [1951].

A spray containing 0·05 per cent. DDT as an emulsified solution was tested with the addition of a wetting agent against *Anuraphis padi* (L.) (*Brachycaudus helichrysi* (Kalt.)) on plum in south-western England in 1948–50. It gave insufficient mortality in 1948–49 when applied after flowering with 0·25 or 0·5 per cent. of the wetting agent, as the Aphids were protected within the curled leaves, but complete control when applied with 0·25 per cent. of the wetting agent at bud-burst in 1950.

KROGH (A.) & WEIS-FOGH (T.). **A Roundabout for studying sustained Flight of Locusts.**—*J. exp. Biol.* **29** no. 2 pp. 211–219, 5 figs., 6 refs. London, 1952.

The authors give a description of a roundabout that was designed for studying the flight of locusts, together with the results of preliminary experiments with *Schistocerca gregaria* (Forsk.). It consists of a horizontal ring 2 metres in diameter suspended by spokes from a vertical hub resting on ball-bearings. Up to 32 locusts are suspended from the ring by bars, and the resistance of the apparatus is compensated by means of a mill, so that the locusts have to overcome only their own air resistance. The speed of the ring therefore equals their preferred average flying speed. The average speed during a period and the variation in speed during an experiment were found to be similar to those of single locusts flying in front of a wind tunnel, which adopt a completely normal flying posture. It is concluded that the results with the two methods are equally valid.

In the experiments, which were mostly carried out in subdued light, groups of 8–32 locusts flew continuously for 4–5 hours, with a maximum of 9 hours. At 25–35°C. [77–95°F.] and with a water-vapour deficit not exceeding 15 mm. mercury, the initial flying speed was 4–4·5 metres per second, but after half an hour the locusts usually flew at an average speed of about 3 metres per second [6·7 miles per hour]. Sudden stimuli, such as flashes of bright light, noise or change in temperature, temporarily increased speed.

The average flying speed decreased between 25 and 22°C. [71·6°F.], which was the lower limit for sustained flight ; the upper limit was 37°C. [98·6°F.], but it appeared to be raised when humidity was increased.

WEIS-FOGH (T.). **Fat Combustion and Metabolic Rate of flying Locusts** (*Schistocerca gregaria* **Forskål**).—*Phil. Trans.* (B) **237** no. 640 pp. 1–36, 12 figs., 2¾ pp. refs. London, 1952.

The following is based on the author's summary. The nature and amount of fuel used by flying *Schistocerca gregaria* (Forsk.) were estimated from direct analyses of the total content of fat and glycogen in groups of laboratory-reared locusts resembling phase *transiens* or *gregaria* that had flown continuously for several hours and also in control groups. Because of the uniformity of the groups and the high rate of metabolism during flight, the latter could be estimated to within about 15 per cent. The locusts were suspended from a roundabout [*cf.* preceding abstract] and could choose their own flying speed. The speeds and duration of flight were similar to those observed in natural swarms. Immature adults were found to contain large amounts of lipids, averaging 10 per cent. of the fresh weight ; about 85 per cent. of the stored energy was in the depot fat. The cuticle and wing muscles of mature adults contained three times as much dry matter as those of newly emerged adults, which flew

little if at all ; the accumulation of dry matter in the latter continued for 2–3 weeks. In all the experiments, and regardless of the age, sex, training or food of the locusts, an average of 80–85 per cent. of the total energy expenditure during the first five hours of flight was derived from fats or fatty acids, the rest being derived from glycogen, most of which was probably used during the first hour. Flight was nevertheless maintained for several hours without reduction in speed [*cf. loc. cit.*]. The metabolic rate on the roundabout increased approximately with the square of the flying speed, which was almost independent of temperature and varied between 2·3–3·7 metres per second, with a mean of 3 metres per second [6·7 miles per hour]. The average metabolic rate was about 75 kilocalories per kg. body weight per hour. For the first few minutes of flight, the rate was three times as high, and at ordinary flying speeds, rates twice as high were sometimes maintained for several hours. An average flight of five hours at 3 metres per second required twice as much energy as was contained in the constituent proteins of the wing muscles, and sustained flight therefore requires large-scale transport of fuel from stores to muscles ; 85–90 per cent. of the energy was supplied by the fat-body, and the rest from wing muscles, legs and wings.

It is suggested that in migrating swarms, the milling and surging of groups of locusts in the morning prior to mass departure tends to use up the store of glycogen and the migratory flight therefore takes place at the expense of fat and its duration is proportional to the amount of fat stored. Average locusts containing 10 per cent. fat (fresh weight) should be able to fly for about 12 hours, with an upper limit of 20 hours for locusts with 15–16 per cent. fat. A migrating swarm probably eats 1–3 times its weight of vegetation daily, and sufficient time and opportunity for feeding are essential for migration.

The wing muscles converted energy at rates of 400–800 kilocalories per kg. muscle per hour, and fat cannot therefore be an inferior fuel, even for intense muscular work, in well-oxygenated muscles. Initial mobilisation seems to be slower for fat than for glycogen, and the utilisation of the latter at the beginning of flight is therefore of advantage, whereas the weight economy, and therefore the duration of flight, is decisively improved by the ability to use stored fat.

ALBRECHT (F. O.). **The Reliability of the E/F Ratio, a Measure of Phase Status, in fresh and in dried Locusts (Orthoptera).**—*Proc. R. ent. Soc. Lond.* (B) **21** pt. 11–12 pp. 167–169, 1 graph, 3 refs. London, 1952.

The following is the author's summary. Tests have been made on *Nomadacris septemfasciata* (Serv.) to discover whether estimates of phase status of locust populations based on E/F ratios are affected when the measurements are made on fresh specimens instead of on dry specimens. There is a tendency for the mean ratio to be higher in dried specimens, but it is very slight and is not significant with 100 specimens.

PAPERS NOTICED BY TITLE ONLY.

BÖRNER (C.). **Europae centralis Aphides. Die Blattläuse Mitteleuropas : Namen, Synonyme, Wirtspflanzen, Generationszyklen.** [The Aphids of Central Europe : Names, Synonyms, Food-plants, Generation Cycles.]—*Schr. Thüring. LandArbGemeinsch. Heilpflanzenk. Weimar* **4** (*Mitt. Thüring. bot. Ges.* Beih. 3) 484 pp., 79 pp. refs. Weimar, 1952.

MARTIN (J. C.). **A new Braconid from Mexico** [*Triaspis azteca*, sp. n., parasitising *Apion godmani* Wagner].—*Canad. Ent.* **84** no. 1 pp. 30–31. Ottawa, 1952.

WINTERINGHAM (F. P. W.). **Separation and Detection of the Pyrethrin-type Insecticides and their Derivatives by Reversed Phase Paper Chromatography.**—*Science* **116** no. 3017 pp. 452–453, 6 refs. New York, N.Y., 1952.